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APRIL 1987

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SELECTED WATER RESOURCES ABSTRACTS

A monthly publication of the Geological Survey
U.S. Department of the Interior

VOLUME 20, NUMBER 4
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W87-02562 -- W87-03340

The Secretary of the Interior has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Office of Management and Budget through September 30, 1987.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

PREFACE

Selected Water Resources Abstracts, a monthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. These documents cover water resources as treated in the life, physical, and social sciences and the related engineering and legal aspects of the characteristics, supply condition, conservation, control, use, or management of water resources. Each abstract includes a full bibliographic citation and a set of descriptors which are listed in the **Water Resources Thesaurus.** The abstract entries are classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the then Federal Council for Science and Technology.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several services of the Water Resources Scientific Information Center. The cumulative SWRA file from 1968 and monthly updates are available also in magnetic tape through lease from NTIS.

THE WATER RESOURCES SCIENTIFIC INFORMATION CENTER DOES NOT PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Comments and suggestions concerning the contents and arrangement of this bulletin are welcome.

Water Resources Scientific
Information Center
U.S. Geological Survey
MS 425 National Center
Reston, VA 22092

CONTENTS

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER

Includes the following Groups: Properties; Aqueous Solutions and Suspensions.

02 WATER CYCLE

Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION

Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL

Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION

Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING

Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA

Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS

Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES

Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION

Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

SELECTED WATER RESOURCES ABSTRACTS

1. NATURE OF WATER

1B. Aqueous Solutions and Suspensions

PREDICTION OF THE DISTRIBUTION CONSTANT OF SOME SOLUTES CONTAINING HYDROPHILIC FUNCTIONAL GROUPS FROM DATA ON THE SOLUBILITY OF WATER IN ORGANIC SOLVENTS,
Nottingham Univ. (England). Dept. of Pharmacy.
I. Kojima, and S. Davis.
Separation Science and Technology SSTEDS, Vol. 20, No. 2 & 3, p131-151, April-May 1985. 9 fig, 5 tab, 50 ref.

Descriptors: *Distribution constant, *Solutes, *Hydrophilic functional groups, *Solubility, *Organic solvents, Solute-solvent interaction, Mathematical studies, Mathematical equations, Chemical analysis, Chemical reactions.

Information on the distribution of solutes between aqueous and organic phases finds application in areas ranging from the practical aspects of solvent extraction, to analysis, medicinal chemistry, and studies on solute-solvent interactions. Described are some linear free energy relationships that correlate the distribution constant of selected solutes having hydrophilic functional groups, and the solubility of water in the relevant organic solvent. These correlations also take into account relationships between the solubility of water in organic solvents and interfacial tension values as well as the association and hydration of organic solutes in water-saturated organic solvents. The distribution behavior of solutes containing a hydrophilic group between aqueous and different organic phases has been examined for the influence of the organic solvent. The distribution constant has been well correlated with the solubility of water in the organic phase by an equation: log Kd=a log S(H2O) + b. The constant a approximates unity for a solute with a single polar functional group. The dimerization behavior of solutes in different organic phases and the relationship between the solubility of water in a solvent and interfacial tension between water and that solvent have also been examined. (Khumbatta-PTT)
W87-02906

THERMODYNAMIC STUDY OF SOLUTIONS OF LIQUID HYDROCARBON MIXTURES IN WATER,
Virginia Inst. of Marine Science, Gloucester Point.
D. R. Burris, and W. G. MacIntyre.
Geochimica et Cosmochimica Acta GCACAK, Vol. 50, No. 7, p 1545-1549, July 1986. 4 tab, 15 ref. USAF Office of Scientific Research Grant AFOSR-83-0036.

Descriptors: *Thermodynamics, *Solubility, *Hydrocarbons, Solutes, Equilibrium, Estimating, Temperature effects.

The aqueous solubility and vapor-liquid equilibrium phase activity coefficients of binary hydrocarbon mixtures were determined to investigate the hydrocarbon solution process in water. The presence of hydrocarbon co-solutes did not measurably reduce hydrocarbon activity coefficients in the aqueous phase. This contradicts previous studies and indicates that the effects of aqueous phase solute-solute interactions can not be precisely determined from water solubility measurements. In a two-phase liquid hydrocarbon mixture-water system at moderate temperatures, aqueous phase hydrocarbon concentrations can be explained in terms of a component in the hydrocarbon phase, the hydrocarbon phase activity coefficient of that component and the component's pure compound solubility. The presence of water in the hydrocarbon phase becomes more important in determining aqueous phase hydrocarbon concentrations resulting from contact with a liquid hydrocarbon mixture as the temperature increases, but its importance is relatively minor up to 150 C. (Michael-PTT)
W87-03145

2. WATER CYCLE

2A. General

COMPARISON OF MOBED AND HEC-6 RIVER FLOW MODELS,
National Water Research Inst., Burlington (Ontario). Environmental Hydraulics Section.
For primary bibliographic entry see Field 2E.
W87-02669

REVIEW OF FIELD OBSERVATIONS OF RUNOFF GENERATION IN THE TROPICS,
Office de la Recherche Scientifique et Technique Outre-Mer, Bondy (France).
For primary bibliographic entry see Field 2E.
W87-02675

HYDROGEN ISOTOPE STUDY OF LARGE-SCALE METEORIC WATER TRANSPORT IN NORTHERN CALIFORNIA AND NEVADA,
California Univ., Davis. Dept. of Geology.
For primary bibliographic entry see Field 2F.
W87-02686

HYDROLOGICAL INVESTIGATIONS OF DINARIC KARST AT THE KRCIC CATCHMENT AND THE RIVER KRKA SPRINGS (YUGOSLAVIA),
Split Univ. (Yugoslavia). Faculty of Civil Engineering Sciences.
O. Bonacci.
Journal of Hydrology JHYDA7, Vol. 82, No. 3/4, p 317-326, December 30, 1985. 8 fig, 1 tab, 7 ref.

Descriptors: *Groundwater level, *Surface water, *Karst hydrology, *Catchment areas, *Springs, *Yugoslavia, Hydrology, Karst, Groundwater, Spring water, Turbulent flow, Flow.

The relationship between catchment surface- and groundwater and the spring water of a karst river in Yugoslavia was investigated. Discharge decreases from the spring to the outlet (waterfall at the river's spring). Only in flood situations (some 30-60 days a year) are normal hydrological relations found with discharge increasing towards the outlet. The river dries up regularly every year, with the number of days of zero flow increasing from the spring towards the outlet. A high degree of interdependence between groundwater levels in the catchment and the discharge of the springs has been demonstrated. Analytical expressions for the discharge curves as a function of the groundwater level have been defined. Two zones with turbulent conduit flow have been discovered, one at the surface and the second about 30-100 m under the surface. (Cassar-PTT)
W87-02845

DETERMINATION OF RAINFALL EXCESS ON SPATIALLY VARIABLE CATCHMENTS,
Monash Univ., Clayton (Australia). Dept. of Civil Engineering.
R. Rajendran, and R. G. Mein.
Journal of Hydrology JHYDA7, Vol. 83, No. 1/2, p 67-89, January 15, 1986. 7 fig, 4 tab, 53 ref. Australian Water Resources Council Project 78/96.

Descriptors: *Rainfall, *Excess rainfall, *Catchment areas, *Spatial distribution, *Simulation analysis, *Model studies, Distribution, Infiltration, Permeability coefficient, Simulation, Mathematical studies, Runoff, Engineering.

The spatial variability of excess rainfall generation across a catchment is simulated by its subdivision into a number of conceptual sub-areas, each of which is considered homogeneous. The infiltration characteristics for each sub-area are determined using a log-normally distributed scaling factor applied to the catchment average hydraulic conductivity. The developed spatial loss model has one fitted parameter (the standard deviation of the scaling factor); other parameter values are determined from catchment characteristics. Application of the model to event data on 11 catchments produced results consistent with the source-area concept of runoff generation. For a majority of independent event tests, the runoff volume was predicted to within plus or minus 2.5 mm. Poorer results were obtained for summer events, probably due to the failure to account adequately for soil cracking. (Author's abstract)
W87-02853

2B. Precipitation

EFFECT OF RAINFALL EXCESS CALCULATIONS ON MODELED HYDROGRAPH ACCURACY AND UNIT-HYDROGRAPH PARAMETERS,
Geological Survey, Urbana, IL. Water Resources Div.
G. Garklavs, and K. A. Oberg.
Water Resources Bulletin WARBAQ, Vol. 22, No. 4, p 565-572, August 1986. 3 fig, 4 tab, 18 ref.

Descriptors: *Excess rainfall, *Flood forecasting, *Hydrographs, *Hydrograph analysis, *Rainfall-runoff relationships, Prediction, Computer programs, Computer models, Hydrologic models, Illinois, Mathematical equations, Parametric hydrology, Regression analysis.

The Initial and Uniform method and the Exponential method of the Corps of Engineers flood hydrograph package (HEC-1) for computing excess rainfall were compared to evaluate the effects on modeled hydrograph accuracy. Time of concentration and storage coefficient parameters were also compared. Rainfall and runoff data from 209 storms in 32 gaged basins in Illinois were used to calibrate the HEC-1 model. The sum of incremental flows, peak discharge and time of peak discharge characteristics were used to evaluate model accuracy. Mean percent error for each basin and hydrograph characteristic were computed. Excess rainfall that was computed using either method resulted in a computed hydrograph accuracy that fell within generally accepted limits. Application of a linear-regression model showed no significant differences in computed values of unit hydrograph parameters. (Michael-PTT)
W87-02623

EVALUATION OF WEEKLY AND MONTHLY TIME SERIES FORECASTS OF MUNICIPAL WATER USE,
Brazos River Authority, Waco, TX.
For primary bibliographic entry see Field 6A.
W87-02629

COMPOSITION OF PRECIPITATION WATER AND ITS ACIDITY,
Akademie der Wissenschaften der DDR, Berlin. Inst. fuer Geographie und Geooekologie.
For primary bibliographic entry see Field 5B.
W87-02721

STUDY OF ACID DEPOSITION IN SWITZERLAND: TEMPORAL VARIATION IN THE IONIC COMPOSITION OF WET PRECIPITATION AT RURAL SITES DURING 1983-1984,
Bern Univ. (Switzerland). Inst. of Plant Physiology
For primary bibliographic entry see Field 5B.
W87-02763

MEASUREMENTS OF PH VERSUS DROP SIZE IN NATURAL RAIN,
Auckland Univ. (New Zealand). Dept. of Physics.
S. J. Adams, S. G. Bradley, C. D. Stow, and S. J. de Mora.
Nature NATUAS, Vol. 321, No. 6073, p 842-844, June 26, 1986. 3 fig, 2 tab, 6 ref.

Descriptors: *Rain, *Acid rain, *Acidity, *Raindrop size, *Measuring instruments, *Chemistry of precipitation, Mass transfer, Chemical properties, Rainfall, Spectrometers, Physical properties.

Results from numerical scavenging models, which estimate the acidity of precipitation falling through a polluted atmosphere, have previously been compared with pH measurements of bulk rain water or of single drops of unknown size. An instrument is described which, for the first time, allows the variation of pH with drop size to be evaluated. The raindrop spectrometer uses the increase of terminal velocity with drop size to sort drops. It consists of two disks separated by a small vertical rotating shaft. The upper disk has a small sector-shaped aperture through which rain passes, and the lower disk is divided into sectors by radial walls to collect water. Because the disks rotate at the same rate, larger drops (falling at higher speeds) intersect the lower disk more nearly beneath the aperture than do smaller drops. Field measurements show a pH minimum for drops with radii near 0.5 mm, consistent with simple mass transfer considerations. (Doria-PTT)
W87-02811

TEMPORAL EVOLUTION OF NITROGEN COMPOUNDS IN SWEDISH PRECIPITATION SINCE 1955,
Stockholm Univ. (Sweden). Meteorologiska Institutionen.
H. Rodhe, and M. J. Rood.
Nature NATUAS, Vol. 321, No. 6072, p 762-764, June 19, 1986. 2 fig, 1 tab, 18 ref.

Descriptors: *Nitrogen compounds, *Acid rain, *Sweden, *Chemistry of precipitation, *Acidity, Nitrates, Ammonium compounds, Ions, Air pollution effects, Nutrients, Sulfates, Vegetation effects.

Nitrate and ammonium ions are important determinants of the ionic strength and pH of precipitation, while their deposition on vegetation and on the ground constitutes a significant source of nutrients for plants. Data from Rothamsted, UK indicate that the mean concentration of nitrate in precipitation doubled between the 1850s and 1960, while ammonium concentration probably increased between the 1880s and 1960. A review of precipitation chemistry data from Europe indicates an approximately threefold increase in nitrate deposition between the 1890s and the late 1970s. The present analysis of data from the European Air Chemistry Network reveals that the nitrate concentration at most stations approximately doubled between the late 1950s and early 1970s, with a less pronounced increase in ammonium. Detailed analysis of data from 12 Swedish stations showed no further increase of nitrate or ammonium between 1972 and 1984. In contrast, the sulfate concentration decreased by about 30% for the same locations and time period. (Author's abstract)
W87-02812

DETERMINATION OF RAINFALL EXCESS ON SPATIALLY VARIABLE CATCHMENTS,
Monash Univ., Clayton (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W87-02853

METEOROLOGICAL DATA ANALYSIS FOR DRAINAGE SYSTEM DESIGN,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
B. J. Adams, H. G. Fraser, C. D. D. Howard, and M. S. Hanafy.
Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 5, P 827-848, October 1986. 24 fig, 2 tab, 12 ref.

Descriptors: *Data analysis, *Design storms, *Drainage systems, *Rainfall-runoff relationships. Rainfall, Catchment areas, Runoff, Performance objectives, Storm intensity, Frequency, Moving window analysis, Storm event analysis, Statistics.

The frequency analysis of point rainfall data examined with particular emphasis on the distinction between meteorological events observed in nature and the definition of events for statistical analysis. A meteorological event may involve several periods of intermittent rain, all of which are associated with the same atmospheric disturbance. The return period of such an event is determined from analysis of synoptic data. In contrast, statistical events are based on the external characteristics (volume, duration, average intensity, and interevent time) of recorded rainfall, without reference to the return period of the synoptic conditions which caused that rainfall. Statistics of storm event characteristics were calculated, correlations between characteristics were explored, and probability density functions for individual storm event characteristics and for combinations of characteristics were developed. Intensity-duration-frequency analyses were performed. A frequency analysis on rainfall volumes demonstrated that event volumes derived from an intensity-duration frequency (IDF) curve do not have the same frequency as that IDF curve. It is concluded that for a particular location, there is no single design storm that is suitable for all types of drainage designs. (Author's abstract)
W87-02882

ENVIRONMENTAL CHEMISTRY OF RAINWATER IN SRI LANKA,
Sri Lanka Univ., Peradeniya. Environmental Geochemistry Research Group.
C. B. Dissanayake, and S. V. R. Weerasooriya.
International Journal of Environmental Studies IJEVAW, Vol. 26, No. 1/2, p 71-86, 1985. 11 fig, 2 tab, 10 ref.

Descriptors: *Rain, *Rainfall chemistry, *Sri Lanka, *Classication, *Highlands, Calcium, Magnesium, Bicarbonates, Chlorides, Climate zones.

Rainwater samples collected from different parts of Sri Lanka were analyzed chemically. Except for minor occurrences, 'acid rain' is not prevalent in Sri Lanka. Based on its chemical composition, rainwater of Sri Lanka has been classfied chemically into eight different types, of which the most dominant are Ca/Mg-HCO3, Ca-Cl, and non-dominant cation-HCO3 types. The wet zone of the country, particularly around the central highlands, forms a special zone characterized by the occurrence of a number of chemically different rainwater types. In contrast, the dry zone receives four distinct types of rainwater. (Author's abstract)
W87-03023

LESSONS FROM FIELD EXPERIENCE WITH RAINWATER COLLECTION SYSTEMS IN AFRICA AND ASIA,
For primary bibliographic entry see Field 5F.
W87-03042

EVOLUTION OF PMP COOPERATIVE STUDIES,
Corps of Engineers, Washington, DC.
For primary bibliographic entry see Field 8A.
W87-03063

MODELLING THE EFFECTS OF ACIDIC DEPOSITION AND CONIFER AFFORESTATION ON STREAM ACIDITY IN THE BRITISH UPLANDS,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 5C.
W87-03068

RESPONSE OF CONSERVATION TILLAGE SORGHUM TO GROWING SEASON PRECIPITATION,
Agricultural Research Service, Bushland, TX. Conservation and Production Lab.
For primary bibliographic entry see Field 3F.
W87-03167

RATES OF MINERAL ELEMENT LEACHING FROM LEAVES OF NINE PLANT SPECIES FROM A SOUTHERN APPALACHIAN FOREST SUCCESSION SUBJECTED TO SIMULATED ACID RAIN,
Georgia Univ., Athens. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W87-03206

POSSIBLE ROLE OF SYMMETRIC INSTABILITY IN THE FORMATION OF PRECIPITATION BANDS,
Massachusetts Inst. of Tech., Cambridge. Center for Meteorology and Physical Oceanography.
M. A. Seltzer, R. E. Passarelli, and K. A. Emanuel.
Journal of the Atmospheric Sciences, JAHSAK Vol. 42, No. 20, p 2207-2219, October 15, 1986. 11 fig, 5 tab, 14 ref.

Descriptors: *Precipitation bands, *Instability, *Frontal regions, *Meteorology, Theoretical analysis, Temperature, Symmetry, Weather patterns, Weather, Precipitation, Remote sensing, Flow pattern.

Fifteen cases of banded and nonbanded precipitation not associated with surface frontal regions are presented. Results from the linear perturbation and parcel theories of symmetric instability are compared to the observed properties of these bands. Symmetric instability can explain many of the features of the bands considered in this study: all of the bands are aligned parallel to the thermal wind; strong shear and near-neutral static stabilities are observed when bands occur; and multiple bands have a wavelength that is related to the depth of the unstable region and the slope of moist isentropic surfaces. However, the linear theory of symmetric instability assumes a basic state of unidirectional flow and thermal wind balance, while the observations indicate that in some cases these conditions are not met. This study supports the hypothesis that symmetric instability may be responsible for precipitation bands, but the comparison between theory and observations is hampered by the inability of the present theory to account for ageostrophic shear and curved flow, and an inability to assess geostrophy via sparse soundings. (Author's abstract)
W87-03213

RESPONSE OF CLOUD SUPERSATURATION TO RADIATIVE FORCING,
Purdue Univ., Lafayette, IN. Dept. of Geosciences.
R. Davies.
Journal of the Atmospheric Sciences, JAHSAK Vol. 42, No. 24, p 2820-2825, December 15, 1985. 1 fig, 2 tab, 13 ref. NASA Grant No. NAG 5-101.

Descriptors: *Clouds, *Precipitation, *Supersaturation, *Radiation, Air temperature, Thermal energy, Saturation, Evaporation.

The diffusional growth or evaporation of cloud droplets due to net emission or absorption of radiation is studied. Time dependent solutions for droplet temperatures and supersaturation are obtained, taking into account the partitioning of the net radiation budget between the droplets and the ambient air. Radiative perturbations are shown to cause extremely high rates of change in droplet temperatures. Due to an efficient exchange of thermal energy within the cloud, the time constant for reducing these rates to the ambient rate is typically less than a few milliseconds, and is approximately proportional to the square of the droplet radius. As the droplets evaporate or grow due to radiative effects, the saturation ratio of the ambient air adjusts due to changes in the water vapor density and the temperature of the air. The time constant for adjustment is found to be a few seconds, and the steady state saturation ratio decreases linearly with increased net radiation absorbed by the cloud. Droplet growth caused by longwave emission occurs under slightly supersaturated conditions. The net radiation budgets of individual droplets, and the supersaturation appear to affect the evolution of the droplet size distribution, but are not needed to assess radiatively induced changes in the cloud temperature and liquid water content, which depend only on the total radiation budget of the cloud. (Author's abstract)
W87-03214

STRUCTURE, ENERGETICS AND PROPAGATION OF ROTATING CONVECTIVE STORMS. PART I: ENERGY EXCHANGE WITH THE MEAN FLOW,

Oklahoma Univ., Norman. School of Meteorology.
D. K. Lilly.
Journal of the Atmospheric Sciences, JAHSAK Vol. 43, No. 2, p 113-125, January 15, 1986. 6 fig, 1 tab, 37 ref, append.

Descriptors: *Convective storms, *Precipitation, *Rainstorms, *Design storms, *Kinetics, Flow, Storm energy, Vortices, Rotational flow.

A three-dimensional, buoyant, convective element, responds to the existence of mean vertical shear by developing rotation about a vertical axis, with the rotational kinetic energy abstracted from that of the mean flow. This process is illustrated with the aid of linear analysis. From consideration of nonlinear processes it is concluded that a portion of the rotational energy is transformed into that of the overturning velocity field, thus enhancing further buoyant energy release. The storm structure which is optimal for energy transfer from the mean flow to rotational disturbances, is a single updraft propagating with the mean flow and with counter-rotating vortices on both sides. The transfer of energy from rotational to overturning modes is, however, optimized by laterally propagating updrafts with coincident vortices. (Author's abstract)
W87-03215

ATMOSPHERIC INPUTS AND RIVER TRANSPORT OF DISSOLVED SUBSTANCES,
Ecole Normale Superieure, Paris (France). Lab. de Geologie.
M. Meybeck.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 173-192, 4 fig, 5 tab, 43 ref.

Descriptors: *Rivers, *Solute transport, *Dissolved solids, *Weather patterns, Path of pollutants, Fate of pollutants, Chemical reactions, Biological properties, Weathering, Chemical analysis, Carbon, Nitrogen, Sulfur, Potassium, Magnesium, Calcium, Phosphorus, Water pollution sources.

Several different types of behavior can be observed for elements between atmospheric input and river transport including very limited chemical or biological reactivity (Cl(-), in most cases), change of speciation (C, N, P), recycling to atmosphere (C, N, S, K), increase of dissolved contents through weathering (Si, Ca, Mg, Na), and build-up in soil or vegetation (C, N, P, Ca, Mg, K). Internal cycling within the soil and biosphere reservoirs is generally one or two orders of magnitude higher than wet and dry fallout rates or stream outputs. The influence of atmospheric input on river chemistry is exemplified by French streams, where it depends on the erodability of basin rocks and on atmospheric inputs regulated by the distance to the Atlantic coast, wind-blown dust, vegetation aerosol release, and anthropic inputs. For any major element (X sub i), the atmospheric contribution to stream transport can be estimated on the basis of the stream Cl(-) content, the rainfall/runoff ratio in the basin, and the regional X sub i/Cl(-) ratio in rainfall. For nutrients, the atmospheric influence can only be estimated from drainage basin budgets which include all organic material output by streams. New estimates of the natural world average for rain and river composition are given for 10 elements and 18 specific forms, and from these are calculated the following contributions of natural wet and dry fallout to the global river transport to the ocean: Cu, 4%; Ca, 6%; Mg, 19%; Na, 53%; K, 27%; Cl, 72%; S, 42%; P, 11%; N, 170%; org. C, 41%. Cyclic marine salts contribute to the average natural fallout rates over the esoreic part of the continents as follows: Ca, 40%; Mg, 76%; Na and Cl, 100%; K, 53% and S, 46%. The remaining part of this fallout is from natural continental origin. (See also W87-03272) (Author's abstract)
W87-03287

INTERIM PROGRESS REPORT, VOLUME I: SCPP METEOROLOGICAL AND STATISTICAL SUPPORT FOR PERIOD 1 SEPTEMBER 1984 THROUGH 31 AUGUST 1985,
Electronic Techniques, Inc., Fort Collins, CO.
A. W. Huggins, J. O. Rhea, G. L. Hemmer, A. P. Kuciauskas, and C. J. Wilcox.
Available from the National Technical Information Service, Springfield, VA. 22161. October 1985. Contract No. 4-CR-81-03860. 241 p, 94 fig, 23 tab, 30 ref, 5 append.

Descriptors: *Cloud seeding, *Weather modification, *Precipitation, Sierra Nevada, Orographic precipitation, Radar, Satellite technology, Model studies, Carbon dioxide, Silver iodide.

Seeding effects in radar data are described for convective clouds seeded with CO2 and AgI. The passage of certain radar echoes was found to be associated with lowering cloud top and an increase in supercooled liquid water (SLW) at Kingvale. In conjunction with satellite data such correspondence may be used to help predict the occurrence of clouds suitable for seeding experiments. One detailed case study revealed as situation where SLW was plentiful in a region upwind of the crest, but was negligible near the crest because of depletion by secondary ice crystal production. Efforts aimed at upgrading the GUIDE model are discussed. Comparisons are made among model versions and between model winds and measured winds. A technique using data from three rawinsondes was found to give the most reliable targeting information for fixed target seeding experiments. Radiometer and rawinsonde parameter comparisons gave generally poor correlations. Some aggregate studies of microphysical data showed treatment effects in both categories of floating target clouds. The randomization techniques of both floating target and fixed target experiments are described. (Author's abstract)
W87-03327

ACID RAIN: A REVIEW OF THE PHENOMENON IN THE EEC AND EUROPE.
Commission of the European Communities, Luxembourg.
For primary bibliographic entry see Field 5C.
W87-03338

2C. Snow, Ice, and Frost

WHEN SNOW FALLS IN A SMALL TOWN,
B. Quinn.
The American City and County ACCOD3, Vol. 101, No. 4, p 60+, April 1986.

Descriptors: *Snowfall, *Snow removal, Public opinion, Snow accumulation, Financing, Attitudes, Salts.

Snow removal program funding and equipment problems confronting small towns are discussed in terms of public attitudes toward the effectiveness of snow removal programs. Environmental problems of salt application are also briefly examined. (Michael-PTT)
W87-02640

SNOW LOADS IN THE 1985 NATIONAL BUILDING CODE OF CANADA: CURVED ROOFS,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
T. H. R. Kennedy, D. J. L. Kennedy, J. G. MacGregor, and D. A. Taylor.
Canadian Journal of Civil Engineering CJCEB, Vol. 12, No. 3, p 427-438, September 1985. 11 fig, 1 tab, 14 ref.

Descriptors: *Building codes, *Snow, *Load distribution, *Drifting snow, Cold weather construction, Construction methods, Snow cover.

The snow load at any location on a roof is obtained by multiplying the ground snow load for a building locale by a series of factors. This is based on the 1985 National Building Code of Canada (NBCC). Four load cases for curved roofs were examined. A new case for drift-load was developed. A simplified method for establishing specified load intensities, shear forces, and bending moments, suitable for preliminary design is also presented. (Kane-PTT)
W87-02667

DEPOSITION OF ATMOSPHERIC TRACE METALS IN NORTHERN SWEDEN AS MEASURED IN THE SNOWPACK,
Stockholm Univ. (Sweden). Meteorologiska Institutionen.
For primary bibliographic entry see Field 5B.
W87-02720

PLACERS OF COSMIC DUST IN THE BLUE ICE LAKES OF GREENLAND,
M. Maurette, C. Hammer, D. E. Brownlee, N. Reeh, and H. H. Thomsen.
Science SCIEAS, Vol. 233, No. 4766, p 869-872, August 22, 1986. 3 fig, 1 tab, 15 ref.

Descriptors: *Placers, *Cosmic dust, *Blue Ice Lakes, *Greenland, Glaciers, Ice cover, Meteoric particles, Water pollution sources, Particles.

Clean polar ice could be good collection sites for small meteoritic particles. However, it was not expected that significant numbers of these particles could be recovered because the spheres should be highly diluted in the ice. Reported is the discovery of a highly effective concentration mechanism occurring in the melt zone of the Greenland ice cap that has produced the highest known concentration of cosmic spheres on the earth. The spheres are concentrated by the melting of the glacial ice and subsequent formation of 'auf eis' lakes that seasonally form directly on the ice surface. The concentration process starts with the particles falling onto the surface of the ultraclean interior of Greenland, where they are buried and become incorporated into ice. The glacial ice flow then carries the particles outward toward the coastal region, where during the summer the ice melts and the liberated particles are carried by running water to placer deposits that form in shallow water basins. The collected particles are generally identical to cosmic spheres found on the ocean floor but a pure glass type was discovered that has not been seen in deep-sea samples. Iron-rich spheres are conspiciously rare in the collected material. (Khumbatta-PTT)
W87-02913

EFFECT OF STANDING SMALL GRAIN STUBBLE ON SNOW COVER CHARACTERISTICS IN ALTERNATE FALLOW STRIP CROPPING,
Montana State Univ., Bozeman. Dept. of Plant and Soil Science.
J. M. Caprio, G. K. Grunwald, R. D. Snyder, and E. C. Cleary.
Agronomy Journal AGJOAT, Vol. 78, No. 1, p 99-106, January-February 1986. 6 fig, 4 tab, 15 ref.

Descriptors: *Snow cover, *Grain crops, *Grain stubble, *Chinook, *Fallowing, Cropland, Planting management, Snow depth, Snow density, Standing crops, Montana.

Snow cover characteristics in standing small grain stubble and fallow fields were studied over three winters in areas of Montana distinguished by differences in the long term average annual number of chinook events. The first winter was warmer and drier than normal while the last two were wetter and colder. Two transects of four to six experimental sites were established. The climate of one transect was distinguished from the other by a greater long term average annual number of chinook events. Treatments at each site included a fallow area and adjacent stubble area situated in north-south strips about 50 meters wide. Six to 10 observations of snow depth and water in snow were made each winter at all sites. Snow depth was greater in standing stubble fieids and exceeded that in fallow fields by 80% in the drier winter and by 30% during the other two winters. Snow density was slightly greater in fallow fields. The average density of snow cover was measured early in the season and weekly thereafter when snow cover persisted. Snow cover across the standing stubble area was nearly uniform in depth. Significant dif-

ferences between climatic areas in snow depth, water in snow and snow density were found only during the relatively dry first season. (Author's abstract)
W87-02990

ESTIMATING SNOW LOAD IN CALIFORNIA FOR THREE RECURRENCE INTERVALS,
Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.
D. L. Azuma.
Research Note PSW-379, December 1985. 6 p, 1 fig, 2 tab, 17 ref.

Descriptors: *Snow accumulation, *Snow load, *California, *Forecasting, Snow sampling, Lake Tahoe, Snow surveys, Snow.

A key to designing facilities in snowbound areas is knowing what the expected snow load levels are for given recurrence intervals. In California, information about snow load is available only for the Lake Tahoe Basin. About 280 snow courses in the State were analyzed, and snow load estimated and related to elevation on a river basin and statewide level. The tabulated snow load was estimated for three recurrence intervals - 25, 50, and 100 years - for each snow course. No relationship was found between elevation and snow load on either a statewide or river basin level. (Author's abstract)
W87-03336

2D. Evaporation and Transpiration

EVAPORATION FROM THE UNDERSTOREY IN THE JARRAH (EUCALYPTUS MARGINATA DON EX SM.) FOREST, SOUTHWESTERN AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Groundwater Research.
E. A. N. Greenwood, L. Klein, J. D. Beresford, G. D. Watson, and K. D. Wright.
Journal of Hydrology JHYDA7, Vol. 80, No. 3/4, p 337-349, October 1985. 7 fig, 3 tab, 6 ref.

Descriptors: *Evaporation, *Forest hydrology, *Flora, *Understory, *Australia, *Hydrologic budget, *Soil water, Eucalyptus, Annual evaporation, Rainfall, Leaves, Jarrah forest, Banksia grandis.

Annual evaporation from groundflora, litter, and soil of the jarrah forest, Australia, was estimated from measurements of daily evaporation by ventilated chambers on several days over two separate 12-month periods. In the first year, when sampling ranged over 0.1 ha of forest, annual evaporation during daylight hours was estimated as 410 mm (0.32 rainfall). In the second year, sampling was more frequent, on a larger scale, and included the night hours. Annual evaporation was estimated at 360 mm (0.36 rainfall). Similarly, in the second year, annual evaporation from two trees of the dominant middle story species, Banksia grandis, was estimated at 7500 and 18,9001 respectively. The leaf area of these two trees was 9.6 and 22.4 m(2), respectively, so that annual evaporation, when expressed as mm(3) per mm(2) leaf area, was similar for both trees (mean = 820 + or - 30 mm). Applying that value to all Banksia trees in a hectare of forest, and using a measured estimate of leaf area index of 0.19, the estimated annual evaporation from the Banksia component was 155 mm (0.16 rainfall). For the upland part of the forest sampled, the combined annual evaporation from the lower and middle storys accounted for about half (0.51) of the annual rainfall. It is concluded that reduced evaporation from the upper story following clearing or thinning may be strongly counteracted by increased evaporation from the understory due to increased availability of energy and water. (Author's abstract)
W87-02679

TIPS ON TRICKLE,
For primary bibliographic entry see Field 3F.
W87-02761

$5.00, 1-MINUTE EFFLUENT QUALITY TESTER,
Salina Area Vocational-Technical School, KS.
For primary bibliographic entry see Field 7B.
W87-02814

TECHNIQUES FOR WATER-USE MEASUREMENTS OF CROP PLANTS,
Kansas Agricultural Experiment Station, Manhattan. Evapotranspiration Lab.
For primary bibliographic entry see Field 7B.
W87-02949

DRYLAND GRAIN SORGHUM WATER USE, LIGHT INTERCEPTION, AND GROWTH RESPONSE TO PLANTING GEOMETRY,
Agricultural Research Service, Bushland, TX. Conservation and Production Lab.
For primary bibliographic entry see Field 2I.
W87-03008

EVAPORATION DATA FROM A CAPILLARY EVAPORIMETER,
Agricultural Univ., Wageningen (Netherlands). Dept. of Physics and Meteorology.
For primary bibliographic entry see Field 7B.
W87-03073

EFFECT OF SHORT-TERM WATER STRESS ON LEAF GAS EXCHANGE PROCESSES AND PLANT WATER POTENTIAL IN SCHEFFLERA,
Antwerp Univ., Wilrijk (Belgium). Dept. of Biology.
For primary bibliographic entry see Field 2I.
W87-03104

PRODUCTION FUNCTION FOR COTTON WITH DATED IRRIGATION QUANTITIES AND QUALITIES,
California Univ., Riverside.
For primary bibliographic entry see Field 3F.
W87-03189

2E. Streamflow and Runoff

EFFECT OF RAINFALL EXCESS CALCULATIONS ON MODELED HYDROGRAPH ACCURACY AND UNIT-HYDROGRAPH PARAMETERS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 2B.
W87-02623

MODELING NORTH CASCADES ANNUAL RUNOFF DISTRIBUTION USING DRAINAGE BASIN ELEVATION DISTRIBUTION,
Seattle City Light Dept., WA.
P. Irvin.
Water Resources Bulletin WARBAQ, Vol. 22, No. 4, p 597-599, August 1986. 2 fig, 1 tab, 1 ref.

Descriptors: *Computer models, *Washington State, *Runoff forecasting, *Catchment areas, *Elevation, *Runoff distribution, *Drainage basins, Annual runoff, Modeling, Prediction.

A method was developed to quantify the similarities of basin characteristics and a computer program was developed to sequentially select one basin and compare the similarity of its elevation and annual runoff distribution to those of other drainage basins. A prediction was performed for the North Cascades region of Washington State. It is concluded that an effective method for determining annual flow distribution is to model ungaged flows in the same way as flows from a gaged basin with elevation distribution similar to that of the subject basin. (Michael-PTT)
W87-02627

COMPARISON OF MOBED AND HEC-6 RIVER FLOW MODELS,
National Water Research Inst., Burlington (Ontario). Environmental Hydraulics Section.
B. G. Krishnappan.
Canadian Journal of Civil Engineering CJCEB, Vol. 12, No. 3, p 464-471, September 1985. 3 fig, 2 tab, 21 ref.

Descriptors: *Mathematical models, *River flow, *Flow pattern, *Flow characteristics, *Computer models, *Flood forecasting, Saskatchewan River, Gardiner Dam, MOBED flow models, HEC-6 flow models, Lake Diefenbacher, Forecasting, Predictions.

In this comparative study, models HEC-6 and MOBED were compared and the major differences between them were identified by examining the basis of each model. It has been established that MOBED has a wider range of applicability than HEC-6. MOBED is an unsteady flow model whereas HEC-6 is a steady state model. Since HEC-6 neglects dynamic effects it cannot be applied to flows whose conditions change rapidly, such as flood flows and flows with tidal influences. MOBED considers the mobile boundary roughness characteristics explicitly, and there it is well suited for flows transporting sediment. The predictive abilities of these models were also compared by applying each model to an identical data set. The data set corresponds to the South Sasketchewan River reach below Gardiner Dam, and is useful for investigating the degradation of the stream bed due to the creation of Lake Diefenbaker upstream of Gardiner Dam. Comparison of model predictions with measurements reveals that MOBED has predictive capability superior to that of HEC-6. It is evident from the comparison that extensive calibration is required for HEC-6 before it can be used as a predictive tool. (Lantz-PTT)
W87-02669

MIXING COEFFICIENT FOR ICE-COVERED AND FREE-SURFACE FLOWS,
National Water Research Inst., Burlington (Ontario). Hyrdraulics Research Div.
Y. L. Lau.
Canadian Journal of Civil Engineering CJCEB, Vol. 12, No. 3, p 521-526, September 1985. 7 fig, 1 tab, 6 ref.

Descriptors: *River flow, *Ice-covered flow, *Mixing coefficients, *Free surfaces, *Alberta, *Path of pollutants, Sinuosity, Transverse mixing, Solates, Mathematical analysis, Model studies, Canada, Mathematical models.

Transverse mixing coefficients evaluated from dispersion experiments in four river reaches showed almost no change in the values of the dimensionless coefficient e sub z/U sub *H (where e sub z = transverse dispersion coefficient, U sub * = shear velocity, and H = flow depth) between open-water and ice-covered conditions. This agrees with results obtained previously from three river reaches in Alberta, which have characteristics very different from those of the rivers studied in this report. Therefore, it is recommended that, for calculating mixing in an ice-covered stream, the same value of E sub z/U sub *H as that for open-water conditions can be used. The present data also reinforce the suggestion that the sinuosity of a river reach plays an important role in determining the value of the dimensionless mixing coefficient. There also appears to be little difference between ice-covered and open-water data. (Lantz-PTT)
W87-02671

CHARACTERIZATION OF WATER USING COMBINED SEWER OVERFLOWS, (CARACTERIZATION DES EAUX USEES DE DEBORDEMENTS DE RESEAU UNITAIRE),
For primary bibliographic entry see Field 5B.
W87-02672

REVIEW OF FIELD OBSERVATIONS OF RUNOFF GENERATION IN THE TROPICS,
Office de la Recherche Scientifique et Technique Outre-Mer, Bondy (France).
P. L. Dubreuil.

Journal of Hydrology JHYDA7, Vol. 80, No. 3/4, p 237-264, October 1985. 3 fig, 6 tab, 31 ref.

Descriptors: *Runoff rates, *Rainfall-runoff relationships, *Tropic zone, *Arid zone, Rain forests, Tropical regions, Rainfall, Soil characteristics, Vegetation, Watersheds.

Over the last thirty years, French hydrologists have observed flow characteristics at the outlets of small tropical watersheds, characteristics of which vary between arid zones, humid zones, and rain forest zones. Phenomena related to various types of runoff generation have been observed and analyzed. The generation of runoff and subsurface runoff following tropical rainstorms depends on soil surface formations, texture and structure as well as vegetation cover, geological substrata, weathered material and climate. Analysis is also made of experimental rainfall-runoff relationships, the shape of flood hydrographs and the conditions necessary for the occurrence of steady base flow. Scale effects between experimental plot and watershed have been studied to identify any effect this may have upon runoff generation and flow. Tables detail watershed characteristics and relationships between these and rainfall and runoff. (Author's abstract)
W87-02675

WAVE MOVEMENT AND WATER-QUALITY VARIATIONS DURING A CONTROLLED RELEASE FROM KIELDER RESERVOIR, NORTH TYNE RIVER, U. K.,
Loughborough Univ. of Technology (England). Dept. of Geography.
G. E. Petts, T. R. Foulger, D. J. Gilvear, J. D. Pratts, and M. C. Thoms.
Journal of Hydrology JHYDA7, Vol. 80, No. 3/4, p 371-389, October 1985. 7 fig, 2 tab, 10 ref.

Descriptors: *Wave action, *Water quality, *Reservoir releases, *Tyne River, *Kielder Reservoir, Flow discharge, Path of pollutants, Water quality control, Channel flow, Hydroelectric power.

Reservoir releases are becoming a prominent characteristic of regulated rivers. Data are presented to describe variations and down stream patterns of change of flow and water quality during the passage of a controlled release. Over relatively short reaches, such as the 10 km study reach here, flow and water quality changes along the channel are shown to be more closely related to the travel rate of the wavefront, rather than to the speed or magnitude of the wave peak. In particular, the lag effect is not simply related to the magnitude of the discharge change, but to the pre-release flow conditions. The travel rate of the wavefront is also related to the particular pre-release flow conditions at each point along the channel. In-channel sources of both suspended solids and solutes are suggested by the data to be influential in determining the patterns of water quality variation both at a station and downstream. Explanations of suspended solids variations need to consider the significance of both biotic and minerogenic sources, and to take account of hydraulic as well as source-area characteristics which here are seen to produce two distinct peaks, at least within the 10 km study reach. Finally, it must be emphasized that the research design adopted for this study sought to identify the detailed patterns of change of flow and water quality characteristics at a station and along a short 10 km reach. Further research is needed to elucidate the downstream patterns of change within longer channel reaches, of the order of 10-100 km. (Lantz-PTT)
W87-02681

PRELIMINARY MODEL OF LONG-TERM CHANGES IN STREAM ACIDITY IN SOUTHWESTERN SCOTLAND,
For primary bibliographic entry see Field 5G.
W87-02682

CLASSIFICATION OF DRAINAGE BASINS ACCORDING TO THEIR PHYSICAL CHARACTERISTICS; AN APPLICATION FOR FLOOD FREQUENCY ANALYSIS IN SCOTLAND,
Saint Andrews Univ. (Scotland). Dept. of Geography.
M. C. Acreman, and C. D. Sinclair.
Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 365-380, May 1986. 4 fig, 3 tab, 29 ref.

Descriptors: *Catchment areas, *Flood frequency, *Frequency analysis, Floods, Algorithms, Scotland, Mathematical analysis.

If the standardized floods at all sites within a given region are assured to be samples from the same distribution, all data may be combined to yield an estimate of a regional dimensionless flood frequency relationship. Classification of the basins can be performed using the NORMIX multivariate clustering algorithm. The homogeneity of the basins can be tested using a likelihood ratio test of whether standardized data for all basins within a region may be adequately represented by a single regional flood frequency relationship. The method was applied to 168 basins in Scotland and five regions were identified, corresponding to physically reasonable basin types. All but one yielded homogeneous distributions of flood frequency. (Author's abstract)
W87-02683

MODELLING THE EFFECTS OF HYDROLOGICAL CHANGES ON STREAM WATER ACIDITY,
Institute of Hydrology, Wallingford (England).
P. G. Whitehead, C. Neal, and R. Neale.
Journal of Hydrology JHYDA7, Vol. 84, No. 3/4, p 353-364, May 1986. 9 fig, 3 tab, 23 ref.

Descriptors: *Acid streams, *Acid rain, *Acidity, *Mathematical models, Chemical reactions, Buffering capacity, Baseflow, Stream chemistry, Percolation, Aluminum.

A mathematical model describing the hydrology and chemical reactions associated with soil and groundwater compartments in a catchment is used to assess the affects of hydrological changes on stream water acidity. By altering the percolation equation in the model the proportion of baseflow to surface soil flow is altered. This radically affects the stream chemistry and it is shown that increasing baseflow can significantly improve stream quality, reducing acidity and lowering aluminum levels. The results suggest the need for research on the physical means of controlling stream water quality in upland afforested catchments and also illustrates the sensitivity of predictions to changes in the parameters controlling percolation, and hence baseflow. (Kane-PTT)
W87-02684

REAL-TIME KINEMATIC CATCHMENT MODEL FOR HYDRO OPERATION,
University of the Witwatersrand, Johannesburg (South Africa). Water Systems Research Programme.
D. Stephenson.
Journal of Energy Engineering (ASCE) JLEED9, Vol. 112, No. 2, p 104-114, August 1986. 5 fig, 10 ref.

Descriptors: *Catchment areas, *Route sensing, *Rainfall-runoff relationships, *Model studies, *Hydroelectric plants, *Prediction, *Flow, Powerplants, Monitoring, Overland flow, Streamflow, Cost analysis, Flood flow, Computer models, Optimization, Base flow, Numerical analysis, Computers, Rain gages, Gages.

A 5,000 sq km catchment in Transkei, Southern Africa is monitored with 10 rain gages which transmit data to a microcomputer model. The numerical model is based on the kinematic equations with both an overland flow/stream flow component and a subsurface component of flow for 14 sub-catchments. Both flood flows and base flows from the catchment are predicted using the model on a real-time basis. Besides predicting flows ahead by the lag time of the catchment (on the order of one day), projection can be made further ahead using rainfall projections. The low cost of the receiving, transmitting, and processing system is made possible by coupling simple tipping bucket type rain gages through a processor to a standard microcomputer. The numerical model is simple enough to operate on the microcomputer and can readily be extended to assist in operation of the hydroelectric station to optimize the available water. (Author's abstract)
W87-02766

PLAINS COTTONWOOD RECRUITMENT AND SURVIVAL ON A PRAIRIE MEANDERING RIVER FLOODPLAIN, MILK RIVER, SOUTHERN ALBERTA AND NORTHERN MONTANA,
Calgary Univ. (Alberta). Dept. of Geography.
For primary bibliographic entry see Field 2I.
W87-02769

EFFECTS OF DISTURBANCE ON EPIPHYTIC COMMUNITY ARCHITECTURE,
Wisconsin Univ.-La Crosse. River Studies Center.
For primary bibliographic entry see Field 2H.
W87-02806

KINEMATIC OVERLAND FLOW: GENERALIZATION OF ROSE'S APPROXIMATE SOLUTION,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Water and Land Resources.
I. D. Moore.
Journal of Hydrology JHYDA7, Vol. 82, No. 3/4, p 233-245, December 30, 1985. 8 fig, 1 tab, 5 ref.

Descriptors: *Overland flow, *Kinematic flow, *Water surface profiles, *Flow characteristics, *Mathematical studies, Flow, Numerical analysis, Physical properties, Hydrographs, Hydrology.

The approximate kinematic overland flow equation for parallel-sided planar surfaces proposed by Rose et al. has been generalized to include a water surface profile shape factor. Rose's equation assumes that transient water surface profiles can be approximated by the shape of the steady-state water surface profile using the steady-state shape factor (= 0.625). Shape factors have now been derived for rectangular, triangular, and parabolic profiles. Use of the appropriate shape factor during the relevant portion of the hydrograph rise and fall allows improved predictions with Rose's approximate theory. Rose's theory has also been generalized for application to converging and diverging planar surfaces by incorporating a brink depth convergence factor and a water surface profile factor to allow predictions from an equivalent parallel-sided planar surface to be corrected to account for the effects of convergence or divergence on the overland flow hydrograph. These factors can be calculated directly from the physical characteristics of the overland flow plane. (Author's abstract)
W87-02841

DETERMINATION OF RAINFALL EXCESS ON SPATIALLY VARIABLE CATCHMENTS,
Monash Univ., Clayton (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2A.
W87-02853

MODIFIED DIFFUSION EQUATION FOR FLOOD PROPAGATION IN TRAPEZOIDAL CHANNELS,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
W. S. Gonwa, and M. L. Kavvas.
Journal of Hydrology JHYDA7, Vol. 83, No. 1/2, p 119-136, January 15, 1986. 6 fig, 3 tab, 18 ref, append.

Descriptors: *Model studies, *Flood routing, *Open channels, *Estimating equations, *Diffusion coefficient, *Hydrology, Channels, Routing, Slopes, Channel morphology, Morphology, Runoff, Waves, Wave velocity, Numerical analysis, Hydraulics.

The adequacy of the analytically solvable linear diffusion equation used to approximate Saint-Venant's equations for flood routing in open channels was evaluated. The derivation of the diffusion equation was approached assuming a variable trapezoidal channel cross-section, variable channel slope, constant lateral inflow, a generalized velocity-depth relationship, and the diffusion approximation to the full Saint-Venant's momentum equation. A modified equation was obtained which theoretically accounts for channel and wave variations resulting in new non-linear expressions for the wave celerity and diffusion coefficients. Numerical testing on a linearized version of the modified diffusion equation demonstrates that the assumption of constant values for the parameters of the diffusion approximation yields inadequate flood routing results. Since the assumption of constant wave celerity and constant diffusion coefficient in the diffusion equation amounts to the linearization of the equation, the linear form of the diffusion equation is shown to be inadequate for flood routing. Therefore, it is necessary to consider the non-linear form of the diffusion approximation to Saint-Venant's equations as an approximate model for flood routing. (Author's abstract)
W87-02855

EVOLUTION OF A SINGLE WAKE BEHIND A PAIR OF BLUFF BODIES,
Cambridge Univ. (England). Dept. of Engineering.
C. H. K. Williamson.
Journal of Fluid Mechanics JFLSA7, Vol. 159, p 1-18, October 1985. 16 fig, 18 ref.

Descriptors: *Flow characteristics,*Flow around objects, *Fluid mechanics, *Hydrodynamics, *Wakes, *Bluff bodies, *Hydraulics, Vortices, Flow,Streamflow.

The flow behind a pair of bluff bodies placed side by side in a stream was studied using a variety of flow-visualization methods. Vortex-shedding synchronization occurs above a critical gap size between the bodies, either in phase or in antiphase. It was previously assumed that such synchronization forms a wake comprising two parallel vortex streets in phase and in antiphase, respectively. It is found that two antiphase streets are indeed formed, although in-phase shedding leads to the development of a single large-scale wake. The vortices which are formed simultaneously at the cylinders rotate around one another downstream, each pair forming a 'binary vortex'. The combined wake comprises a street of such vortices, here termed a binary vortex street. Below a critical gap size between the bluff bodies, the flow becomes asymmetric. Certain harmonic modes of vortex shedding are observed in this regime, whereby the shedding frequency on one side of the wake is a multiple of that on the other. Again, a large-scale wake is formed downstream. These observations lead to a new interpretation of hot-wire-frequency data from other studies in terms of the harmonic modes. (Author's abstract)
W87-02862

STABILITY OF FLOWS IN CHANNELS WITH SMALL WALL CURVATURE,
Topexpress Ltd., Cambridge (England).
For primary bibliographic entry see Field 8B.
W87-02863

DESIGNING FOR DYNAMIC EQUILIBRIUM IN STREAMS,
Rocky Mountain Forest and Range Experiment Station, Tempe, AZ. Forestry Sciences Lab.
B. H. Heede.
Water Resources Bulletin WARBAQ, Vol. 22, No. 3, p 351-358, June 1986. 24 ref.

Descriptors: *Stream stabilization, *Streams, *Bank erosion, *Dynamic equilibrium, Adjustment processes, Dams, Stream response, Stream discharge, Sediment transport, Channel improvement, Baseline studies, Sedimentation.

Streams in dynamic equilibrium respond quickly to change, regaining a new equilibrium. There is a causative reason why a stream meanders or degrades or aggrades its bed. If humans interfere with them other adjustment processes will be initiated. In contrast, if humans work with the ongoing processes, success will be attainable with less efforts and at a lower cost. Local base level change represents one of the most influential channel changes, especially the lowering of this level. Loss of base level may cause degradation throughout a stream network, because the main stem is the base level for all its tributaries. Often degradation causes bank instability and lowering of steamside water tables that, in turn, endanger the riparian ecosystem. A rise of the local base level does not raise the bed throughout a stream or network; instead, aggradation stops at a given distance. Preventing local base level changes of a stream network, therefore, is a cost-effective measure. Examples are presented of treatments causing new critical situations and measures to correct them, e.g., how a fishery control project may influence the hydraulic geometry of a stream, causing bank erosion. (Author's abstract)
W87-02929

MANAGEMENT OF INSTREAM FLOWS THROUGH RUNOFF DETENTION AND RETENTION,
Bureau of Land Management, Lakewood, CO. Denver Service Center.
For primary bibliographic entry see Field 4A.
W87-02934

POLLUTANTS ASSOCIATED WITH SAND AND SALT APPLIED TO ROADS IN MINNESOTA,
Metropolitan Council, St. Paul, MN.
For primary bibliographic entry see Field 5B.
W87-02943

APPLICATION OF COMPUTER INTENSIVE STATISTICS TO PARAMETER UNCERTAINTY IN STREAMFLOW SYNTHESIS,
Waterloo Univ. (Ontario). Dept. of Systems Design Engineering.
K. A. Cover, and T. E. Unny.
Water Resources Bulletin WARBAQ, Vol. 22, No. 3, p 495-507, June 1986. 10 fig, 2 tab 27 ref, 2 append.

Descriptors: *Computer models, *Statistical methods, *Streamflow, *Statistical models, Parameter uncertainty, ARMA models, Stochastic process, Hydrology, Mathematical models, Computer models.

With the developments in understanding in the application of stochastic methods in hydrology in the last two decades, the synthesis of streamflow data has become a basic part of surface water hydrology. The application of Computer Intensive Statistics (CIS) to the evaluation of parameter uncertainty with specific reference to the parameters in the ARMA models used in the synthesis of streamflows is introduced. CIS provides an empirically derived joint distribution for all parameters. Random values from this distribution can be drawn for application in the model for the generation of a specific synthetic sample. The CIS originally proposed by Efron is of general applicability in the evaluation of uncertainty in any statistic derived from a set of data. (Author's abstract)
W87-02945

DIRECT SOLUTIONS FOR NORMAL DEPTH USING THE MANNING EQUATION,
University of Strathclyde, Glasgow (Scotland). Dept. of Civil Engineering.
D. I. H. Barr, and M. M. Das.
Proceedings of Institutional Civil Engineers PCIEAT, Vol. 81, Part 2 p 315-333, September 1986. 8 fig, 3 tab, 9 ref, 3 append.

Descriptors: *Mannings equation, *Open-channel flow, *Mathematical equations, *Water depth, *Channel flow, Discharge coefficient, Boundary conditions, Conduits, Numerical solutions, channels, Standard error.

The Manning equation relates discharge to channel resistance arising from configuration and boundary roughness in free surface flows. New solution procedures are developed for the implicit problem of determining normal depth. These include a numerical solution for rectangular channels and numerical and graphical procedures for trapezoidal channels and circular conduits running part full. The transform equations for cicular conduits remain explicit when normal depth is input. These equations can also provide solutions for discharge or gradient. Numerical solutions involve a degree of approximation, but error remains within acceptable limits for design purposes. Two alternative solution schemes are provided for trapezoidal channels each of which is based on simple criteria to allow different solution routes to be chosen in a systematic manner. Different forms of solution must be adopted to accommodate the widely varying configurations of trapezoidal channels. (Michael-PTT)
W87-02963

NUTRIENT AND TRACE METAL FLUXES IN THE MAGELA CREEK SYSTEM, NORTHERN AUSTRALIA,
Chisholm Inst. of Tech., Melbourne (Australia). Water Studies Centre.
B. T. Hart, E. M. Ottaway, and B. N. Noller.
Ecological Modelling, ECMODT Vol. 31, No. 1-4, p 249-265, May 1986. 6 fig, 3 tab, 16 ref.

Descriptors: *Path of pollutants, *Transport, *Nutrient fluctuations, *Trace metals, *Magela Creek, *Ions, *Suspended solids, *Mining, *Floods, *Seasonal variation, Nutrients, Australia, Phosphorus, Nitrogen, Iron, Uranium, Manganese, Wet deposition, Rainfall, Copper, Lead, Zinc, Nitrate, Ammonia, Nutrient removal.

The fluxes of suspended matter, major ions, P and N, and trace metals (Fe, Mn, Cu, Pb, and Zn) transported by Magela Creek (northern Australia) to the floodplain during the 1982/83 wet season are reported. The study was aimed at assessing the relative amounts of these materials added naturally from the catchment and from the Ranger uranium mining operation and the township of Jabiru. Generally, the fluxes of all materials were quite low compared with reported values for other world systems. The major proportion of each of the materials was transported during flood events. A considerable proportion of the trace metals were transported as particulate matter. Comparisons of the amounts of material transported by the creek to the floodplain with that deposited in the catchment by rainfall indicated that for most determinants there was little interaction between the catchment and the rain water in its passage through the catchment. Nutrients (P, nitrate, and ammonia) were the exception; these were substantially removed, presumably by catchment vegetation. (Author's abstract)
W87-02974

COMPLEXITY IN COLUMBIA RIVER SYSTEMS MODELING,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W87-03059

ANALYTICAL AND NUMERICAL SOLUTION OF SAINT-VENANT EQUATIONS,
Akademia Rolnicza, Wroclaw (Poland). Dept. of Mathematics.
M. Chalfen, and A. Niemiec.
Journal of Hydrology JHYDA7, Vol. 86, No. 1/2, p 1-13, September 1986. 7 fig, 1 tab, 9 ref.

Descriptors: *Numerical analysis, *Flood routing, *Nysa Klodska River, *Saint Venant equations, *Mathematical equations, Boundary conditions, Differential equations, Preissman method, Mathematical studies, Differential equations, River flow.

Scientists who deal with Saint-Venant equations, find them difficult to work with because of the application of the differential scheme to this equation, and a comparison of the results with observed data is not sufficient. Analytical solutions of Saint-Venant equations with particular initial and bound-

sry conditions are investigated. These solutions were used to prove the correctness of numerical solutions. The general Preissman scheme was used to find the approximate solution. Stability conditions for this scheme are found. The application of the method to investigate flood routing of the Nysa Klodska river (Poland) is described. (Alexander-PTT)
W87-03067

UNBIASED PLOTTING POSITIONS FOR THE GENERAL EXTREME VALUE DISTRIBUTION,
Institute of Hydrology, Wallingford (England).
N. W. Arnell, M. Beran, and J. R. M. Hosking.
Journal of Hydrology JHYDA7, Vol. 86, No. 1/2, p 59-69, September 1986. 3 tab, 11 ref, append.

Descriptors: *Frequency analysis, *Flood frequency, *Statistical analysis, Sequencing, Probabilistic process, Mathematical analysis, Mathematical equations, Flood forecasting.

The general extreme value (GEV) distribution is commonly used for flood frequency analysis, and contains the Gumbel distribution as a special case. While plotting position formulas for this special case are well established, results are not available for the general case. By careful sequencing of the individual terms, it is possible to integrate numerically the basic expression for expected order statistics to compute plotting positions for all practical sample sizes. This integration consumes considerable computer resources, and for sample sizes of 35 and less, exact unbiased plotting positions can be more readily evaluated using expressions derived using probability weighted moment theory. Numerical problems force an alternative approach for larger samples; therefore an asymptotic approximation has been developed, which very accurate for small samples. An exact formulas should be used for the largest flood in a sample. Plotting position formulae have been developed based on expressions for the non-exceedance probability of the form F sub r = (r - alpha)/(n - beta). The parameters alpha and beta are allowed to vary with sample size and the shape parameter of the general extreme value distribution. (Author's abstract)
W87-03071

CHANGES IN CATCHMENT RUNOFF FOLLOWING DRAINAGE AND AFFORESTATION,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 4C.
W87-03072

ESTABLISHING A STORMWATER MANAGEMENT UTILITY,
Cincinnati Dept. of Public Works, OH. Div. of Stormwater Management Utility.
T. A. Stitt.
Public Works PUWOAH, Vol. 117, No. 9, p 126-127, 150, 152, 154, 156, September 1986.

Descriptors: *Storm runoff, Public participation, Cincinnati, Municipal wastewater, Financing, Water rates.

Cincinnati's experience in addressing stormwater problems through establishment of a separate stormwater management utility was reported. Community involvement in establishing the utility and the water rate restructuring required to finance its operations were discussed. Lessons learned in implementing the utility included: (1) You need a storm. Nothing was more helpful for stimulating public interest in the stormwater problem than the two 100-year storms that Cincinnati experienced in 1982. If there is nothing to stimulate public interest, support for the program will likely be difficult to achieve. (2) Positive attitudes help push the program. Because the idea of a stormwater management utility was innovative, there were those who said it would never work. The engineer or manager that directs a study on stormwater needs a positive attitude to combat people who will give a whole list of reasons why something cannot be done. (3) Doing homework paves the road to success. You must document the problem. Information collected must be accurate and given justification. It is not enough to say there is a problem. Proper documentation also is vital when selling the program to the public. (4) Involve as many people as possible in the process. Within your own organization and among the public, make people aware of the problem. The thought of visiting 48 community councils and trying to sell them on a $50 million program may indeed be frightening, but it could make the difference between a plan and an implemented program. (5) Do not create another bureaucracy. Citizens do not want more government, just efficient service. We chose to think small organizationally - 15 to 20 people. Supplement existing stormwater management staff with existing city maintenance organizations and contract for needed design, construction, and additional maintenance services. (Alexander-PPT)
W87-03123

NATURE OF PARTICULATE ORGANIC MATTER IN THE RIVER INDUS, PAKISTAN,
Hamburg Univ. (Germany, F.R.). Geologisch-Palaeontologisches Inst. und Museum.
For primary bibliographic entry see Field 5A.
W87-03148

HYDROLOGIC SIMILARITY: 1. DERIVATION OF THE DIMENSIONLESS FLOOD FREQUENCY CURVE,
Princeton Univ., NJ. Water Resources Program.
E. F. Wood, and C. S. Hebson.
Water Resources Research WRERAQ, Vol. 22, No. 11, p 1549-1554, October 1986. 3 fig, 1 tab, 20 ref. NSF Grant No. CME-79-15168.

Descriptors: *Hydrologic models, *Flood frequency, *Mathematical analysis, *Frequency analysis, Mathematical models, Rainfall intensity, Statistical analysis.

The problem of flood frequency similarity among river basins is analyzed by deriving a scale-independent, dimensionless flood frequency curve. The model is formulated using dimensionless rainfall inputs and a dimensionless basin response function. For rainfall intensity, the probability distribution for dimensionless areal rainfall is derived, and depends upon a geoclimatic scaling factor which is a function of the basin size and the rainfall areal correlation structure. Rainfall duration is scaled by tau, a characteristic basin time. This same parameter is used to develop a dimensionless geomorphologic unit hydrograph. The derived dimensionless flood frequency curve can be used to further understand the variability of flood statistics within a contiguous area and to group stations for regional flood frequency analysis using statistical techniques. (Author's abstract)
W87-03194

HISTORIC TRENDS IN THE SEDIMENT FLOW REGIME OF THE MISSISSIPPI RIVER,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 2J.
W87-03195

VALUE OF HISTORICAL DATA IN FLOOD FREQUENCY ANALYSIS,
Institute of Hydrology, Wallingford (England).
J. R. M. Hosking, and J. R. Wallis.
Water Resources Research WRERAQ, Vol. 22, No. 11, p 1606-1612, October 1986. 6 fig, 4 tab, 17 ref.

Descriptors: *Flood frequency, *Frequency analysis, *Historic floods, Flood recurrence interval, Flood data, Flood forecasting, Mathematical analysis, Regional analysis, Water resources development, Planning.

A common problem in flood frequency analysis is estimation, from a short gauged record, of the flood corresponding to a return period 50-1000 years. One would expect that an estimate of the historical maximum event; i.e., the maximum flood in a period of perhaps 100-200 years, would, if properly included in the estimation procedure, improve the resulting estimate of the flood magnitude at the given return period. Here, an attempt is made to assess the value of historical information using computer simulation. An annual flood sequence and an historical maximum event are generated from an extreme-value distribution (of type I or II) and quantiles of the distribution are estimated by maximum likelihood, both including the excluding the historical event. After many such simulations have been performed the accuracy of the quantile estimates is assessed. It is concluded that in a single-site flood frequency analysis, or a regional analysis using data from a small number of sites, historical information is of great value provided either that historical discharges are accurately estimated or that the flood frequency distribution has at least three unknown parameters. Historical information is also valuable if the flood frequency distribution has high CV or skewness or if gauged records are short. The inclusion of historical information at one site in a regional analysis gives little improvement in the accuracy of flood quantile estimates at other sites in the region. In a regional analysis using a large number of sites, the inclusion of a realistic amount of historical information is unlikely to be useful in practice. (Lantz-PTT)
W87-03200

BED FRICTION AND DISSIPATION IN A COMBINED CURRENT AND WAVE MOTION,
Technical Univ. of Denmark, Lyngby. Lab. of Applied Mathematical Physics.
For primary bibliographic entry see Field 8B.
W87-03210

PHYSIOGENIC AND ANTHROPOGENIC CONTROLS OF GLOBAL AND REGIONAL IONIC RUNOFF,
Martin-Luther-Univ. Halle-Wittenberg, Halle (German D.R.). Sektion Geographie.
K. D. Aurada.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 31-39, 8 fig, 1 tab, 20 ref.

Descriptors: *Runoff plot, *Ion transport, *Path of pollutants, Water pollution control, Waste disposal, Werra Basin, Saale Basin, Wastewater disposal, Calcium, Magnesium, Sodium, Potassium, Sulfates, Chlorine, Bicarbonate.

The average global ionic runoff amounts to 4.3 or 3.6 times 10 to the 9th T/yr, and the average rate of the chemical denudation to 1.3 or 1.1 g/s/sq km. The estimated global anthropogenic ionic input of 0.7 times 10 to the 9th T/yr in local cases leads to a disturbance of the stability in hydrological systems. Ionic runoff and chemical denudation attention is focussed upon the ions Ca(2+), Mg(2+), Na(+), K(+), HCO3(-), SO4(-), Cl(-) and upon the total mineralization of terrestrial surface waters. In order to prevent or to reduce instabilities which may occur in heavily polluted hydrological systems there exist the following possibilities: (a) disposal of highly mineralized sewage through canals outside of the river channel; (b) occasional disposal of highly mineralized sewage into the ground, which has been done in the Werra basin from 1924 or 1925 to 1967; and (c) dilution of highly mineralized sewage by addition of the relatively slightly mineralized water from storage reservoirs, which was started as a trial in the Saale basin in 1943, and has been undertaken regularly since 1963, and underlies the process control system since 1976. (See also W87-03272) (Lantz-PTT)
W87-03275

DISSOLVED MATERIAL CONCENTRATION IN SURFACE WATERS OF AFRICA. TWO CONTRASTING EXAMPLES IN THE RIVERS OF TOGO AND THE MEDJERDAH IN TUNISIA (EVOLUTION DE LA CONCENTRATION EN MATIERES DISSOUTES EN AFRIQUE.

DEUX EXEMPLES OPPOSES: LES FLEUVES DU TOGO ET LA MEDJERDAH EN TUNISIE),
Office de la Recherche Scientifique et Technique Outre-Mer, Bondy (France).
For primary bibliographic entry see Field 5B.
W87-03277

DISSOLVED LOADS IN STREAMS AND RIVERS - DISCHARGED AND SEASONALLY RELATED VARIATIONS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
For primary bibliographic entry see Field 5B.
W87-03279

MULTIVARIATE ANALYSIS OF QUALITY PARAMETERS TO DETERMINE THE CHEMICAL TRANSPORT IN RIVERS,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
For primary bibliographic entry see Field 5B.
W87-03280

RUNOFF PROCESSES AND DISSOLVED SUBSTANCES DURING FLOOD EVENTS IN SMALL DIFFERENTLY USED DRAINAGE AREAS,
Wahnbachtalsperrenverband, Siegburg (Germany, F.R.).
A. Schulte-Wulwer-Leidig, and K. Mollenhauer.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 121-129, 5 fig, 2 tab, 7 ref.

Descriptors: *Runoff, *Dissolved solids, *Floods, *Catchment basins, Streams, Discharge hydrographs, Chemical analysis, Phosphorus, Ammonia, Organic matter, Organic compounds, Nitrates, Path of pollutants.

Flood events are being studied in streams of small drainage basins under different land uses. This research includes study of discharge hydrographs as well as the response of concentrations and loads of several substances, especially those which may originate from arable and pasture land and from fertilizer application and manuring. Only a few flood events are presented and discussed in this paper. Phosphorus, ammonia and dissolved organic substances respond at the beginning of the flood events and attain high levels soon after peak discharge, but concentrations subsequently decline again quickly. The concentrations of nitrates and sulphates are first influenced by dilution effects and then, after a delay in time, increase without reaching significant peaks, although increased levels are maintained for a longer period. Differences in hydrographs and in the concentrations and loads of several substances are apparent between the research basins. (See also W87-03272) (Author's abstract)
W87-03283

FACTORS CONTROLLING THE CHEMICAL COMPOSITION OF RIVER WATERS OF INDIA,
Jawaharlal Nehru Univ., New Delhi (India). School of Environmental Sciences.
V. Subramanian.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 145-152, 3 fig, 3 tab, 9 ref.

Descriptors: *Chemical analysis, *Rivers, *India, Water quality control, Hydrologic regime, Temporal distribution, Monsoon, Chemistry of precipitation, Dissolved solids, China, Sodium, Chlorides, Amazon River, Zaire River.

Extensive analysis of a large number of water samples from rivers draining the Indian sub-continent indicates hydrological, temporal and downstream variations. The chemistry of river waters is partly controlled by chemical weathering, significantly by monsoon precipitation and qualitatively by anthropogenic effects. Total dissolved solids concentration exhibits an inverse relationship with annual runoff. Compared to Chinese and other Asian rivers, Indian rivers are less alkaline but have more Na and Cl. On a global scale, rivers from India carry greater solute flux than the Amazon or Zaire and have a solute yield twice that of the global average. (See also W87-03272) (Author's abstract)
W87-03285

STREAM SOLUTE BEHAVIOUR IN THE RIVER EXE BASIN, DEVON, UK,
Exeter Univ. (England).
For primary bibliographic entry see Field 5B.
W87-03286

ATMOSPHERIC INPUTS AND RIVER TRANSPORT OF DISSOLVED SUBSTANCES,
Ecole Normale Superieure, Paris (France). Lab. de Geologie.
For primary bibliographic entry see Field 2B.
W87-03287

NUTRIENT AND SEDIMENT BUDGETS FOR THE TIDAL POTOMAC RIVER AND ESTUARY,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 5B.
W87-03290

BIOGEOCHEMICAL CONTROLS ON RIVER WATER QUALITY IN A FORESTED DRAINAGE BASIN, WARWICKSHIRE, UK,
Coventry (Lanchester) Polytechnic (England). Dept. of Geography.
I. D. L. Foster, A. D. Carter, and I. C. Grieve.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 241-253, 4 fig, 3 tab, 24 ref.

Descriptors: *Geochemistry, *Rivers, *Water quality, *Catchment areas, *Forests, *Seasonal variation, Warwickshire, England, Rainfall, Nutrients, Nitrogen, Potassium, Canopy, Chlorine, Hydrogen, Phosphates, Soil chemistry.

Rainfall is the main form of precipitation input to the experimental catchment and supplies many essential plant nutrients directly from atmospheric sources. This contribution represents a net gain of nitrogen and potassium to the basin as a whole and has been shown to be important in many ecosystems. The passage of rainfall through a vegetation canopy considerably modifies solute concentrations by the washing of surface deposits from vegetation surfaces or by the leaching of labile ions and compounds from within. The latter effect is particularly noticeable during autumn months when cellular breakdown encourages the release of readily available ions before abcission. This process is especially important in relation to k(+), Cl(-), H(+) and PO4(3-). Nitrogen is the only nutrient to exhibit a decline in concentrations during passage through the vegetation canopy. Most workers have been unable to identify seasonal trends in the nutrient content of soils. This largely reflects the problems of sampling the inherently large spatial variability of the soil. Seasonal variations in soil chemistry under six vegetation types in the Rocky Mountains have been recognized. Several water soluble ions in the present study exhibited significant seasonal variations with peaks in concentration occurring in the winter months. Although depletions of soil nutrient levels have been observed under various agricultural crops, in woodland ecosystems nutrients are supplied continuously to the soil from litter and throughfall inputs. Seasonal increases in concentration may therefore relate to rapid decomposition followed by winter leaching of accumulated mineralized material. Volume weighted river water concentrations draining the entire deciduous woodland area do not exhibit marked seasonal trends, and the fluctuations in nutrient levels in the hillslope subsystem are not generally apparent in the river. Small increases in K(+) and Mg(2+) concentrations occur in June following the period associated with frass inputs, whereas peak nitrogen and PO4(3-) levels are related to times of maximum runoff. (See also W87-03272) (Lantz-PTT)
W87-03292

DISSOLVED AND PARTICULATE LOAD IN DANISH WATER COURSES,
Copenhagen Univ. (Denmark). Inst. of Geography.
For primary bibliographic entry see Field 5B.
W87-03293

STREAM SOLUTE SOURCES AND VARIATIONS IN A TEMPERATE GRANITE DRAINAGE BASIN,
Plymouth Polytechnic (England). Dept. of Geographical Sciences.
For primary bibliographic entry see Field 5B.
W87-03296

DIFFERENT TECHNIQUES FOR THE COMPUTATION OF RIVER NUTRIENT LOADS (METHODOLOGIES DE QUANTIFICATION DES FLUX DE NUTRIMENTS EN RIVIERE),
Centre National du Machinisme Agricole, du Genie Rural, des Eaux et des Forets, Lyon (France).
For primary bibliographic entry see Field 2H.
W87-03298

DISSOLVED AND SUSPENDED LOADS OF THE REGULATED RIVER NIDDA IN THE RHINE-MAIN AREA,
Frankfurt Univ. (Germany, F.R.).
For primary bibliographic entry see Field 5B.
W87-03299

NITRATE LOAD/DISCHARGE RELATIONSHIPS AND NITRATE LOAD TRENDS IN DANISH RIVERS,
Miljoestyrelsen, Copenhagen (Denmark).
For primary bibliographic entry see Field 5B.
W87-03302

COMPARISON OF WATER QUALITY IN DRAINAGE BASINS UNDER AGRICULTURAL AND FOREST LAND USE,
Giessen Univ. (Germany, F.R.). Inst. fuer Mikrobiologie und Landeskultur.
W. Sussmann.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 431-441, 6 fig, 4 tab, 7 ref.

Descriptors: *Water quality, *Catchment areas, *Land use, *Edersee Reservoir, Forests, Agriculture, West Germany, Nutrients, Surface flow, Orthophosphates, Nitrates, Model studies.

In the area to the north of the Edersee Reservoir investigations have been carried out since 1975 into the quality of streamwater in drainage basins with different land use. The main subject of interest is a comparison of the loss of plant nutrients from drainage basins under agricultural and forest land use. The total phosphorus loss from drainage basins under agricultural areas than in forested areas. In comparison, ortho-phosphate concentrations in runoff depend more on the absorption capacity of soils and geological substrates than on land use. Nitrate concentrations in runoff from agricultural areas are markedly higher than those found in wooded drainage basins. The seasonal trends of nitrate concentrations and the concentration patterns during storm events are explained

with reference to several models. (See also W87-03272) (Author's abstract)
W87-03307

ENVIRONMENTAL EFFECTS OF DIKES AND REVETMENTS ON LARGE RIVERINE SYSTEMS,
Iowa Cooperative Wildlife Research Unit, Ames.
For primary bibliographic entry see Field 6G.
W87-03321

MEASURING SUSPENDED SEDIMENT IN SMALL MOUNTAIN STREAMS,
Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.
For primary bibliographic entry see Field 5A.
W87-03324

FLOODPLAIN MANAGEMENT HANDBOOK.
Flood Loss Reduction Associates, Palo Alto, CA.
For primary bibliographic entry see Field 6F.
W87-03330

LOCK AND DAM 1, RED RIVER WATERWAY: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8B.
W87-03333

BURLINGTON SPILLWAY AND OUTLET WORKS SOURIS RIVER, NORTH DAKOTA: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8B.
W87-03334

MILL CREEK CHANNEL, WALLA WALLA, WASHINGTON: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8B.
W87-03335

2F. Groundwater

METABOLICAL ACTIVITY OF BACTERIA IN GEOTHERMAL SPRING-WATERS DATING FROM DOGGER AND TRIAS PERIODS IN THE BASSIN PARISIEN, (ACTIVITES METABOLIQUES DES BACTERIES DES EAUX GEOTHERMALES DU DOGGER ET DU TRIAS DU BASSIN PARISIEN),
Aix-Marseille-1 Univ. (France).
For primary bibliographic entry see Field 5B.
W87-02562

ALTERNATIVES TO THE USE OF AGRICULTURAL DRAINAGE WELLS,
Iowa State Univ., Ames. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 4B.
W87-02624

ANOMALOUS NATURAL SULFATE IN WATER WELLS OF THE GREENBRIER GROUP, WEST VIRGINIA,
Charleston Coll., SC.
For primary bibliographic entry see Field 5B.
W87-02625

CONTAINING LANDFILL LEAKS,
Camp, Dresser and McKee, Inc., Boston, MA.
For primary bibliographic entry see Field 5B.
W87-02639

RESPONSE TO PUMPING OF A WEATHERED-FRACTURED GRANITE AQUIFER,
Birmingham Univ. (England). Dept. of Civil Engineering.
K. R. Rushton, and J. Weller.
Journal of Hydrology JHYDA7, Vol. 80, No. 3/4, p 299-309, October 1985. 7 fig, 4 ref.

Descriptors: *Aquifers, *Groundwater movement, *Pumping tests, *Granite, Field tests, Hydraulic properties, Mathematical models, Transmissivity.

A pumping test in a granitic aquifer provides information about the interaction between the upper weathered zone and the lower fractured zone. Analysis of this pumping test was possible because drawdowns were measured both in deep boreholes in the fractured zone and in shallow boreholes in the weathered zone. A numerical model was used to analyze the test, and for a single set of aquifer parameters, adequate fits to the observed drawdowns were obtained both during the pumping and recovery phases. The transmissivity of the fractured zone is shown to be about ten times greater than the weathered zone. When water is drawn by submersible pump from deep boreholes, the fractured zone acts as a collector and draws water from the weathered zone. Consequently there is a risk of over-exploiting the acquifer. (Kane-PTT)
W87-02676

HIGH CONCENTRATION OF SOLUTES AT THE UPPER PART OF THE SATURATED ZONE (WATER TABLE) OF A DEEP AQUIFER UNDER SEWAGE-IRRIGATED LAND,
Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.
D. Ronen, and M. Magaritz.
Journal of Hydrology JHYDA7, Vol.80, No. 3/4, p 311-323, October 1985. 5 fig, 5 tab, 22 ref.

Descriptors: *Groundwater pollution, *Aquifers, *Wastewater irrigation, *Solutes, *Saturated zone, Irrigation, Wastewater, Groundwater quality, Nitrates, Sulfates, Chlorides, Fertilizers, Path of pollutants, Source of pollutants.

The water-table region (upper 50 cm of the saturated zone) of a 25 m deep phreatic sandstone aquifer, lying under fields irrigated with sewage effluents for up to 22 yrs, was monitored in 1971 and 1984. Average concentrations of N03(-), Cl(-) and SO4(2-) of up to 225, 307, and 155 mg/l, respectively, were detected in the upper 50 cm of the saturated region in two research wells in 1984. These concentrations, which are related to effluent and fertilizer input to groundwater, were two to four times higher than those found deep (37-55 m) below the water table in nearby (1000 m distant) production wells. Nitrate data and the estimated transit time through the unsaturated zone (2 m yr (-1)) support the model suggesting that the major source of nitrate pollution in the past should be related to the oxidation of soil organic matter. The SO4(2-)/Cl(-) ratio is found to be a useful indicator for the arrival of SO4(2-) fertilizers at the groundwater interface. The observations presented question the suitability of plans for using effluents as a water source for agriculture in regions which are the replenishment areas of phreatic aquifers. (Author's abstract)
W87-02677

HYDROGEN ISOTOPE STUDY OF LARGE-SCALE METEORIC WATER TRANSPORT IN NORTHERN CALIFORNIA AND NEVADA,
California Univ., Davis. Dept. of Geology.
N. L. Ingraham, and B. E. Taylor.
Journal of Hydrology JHYDA7, Vol. 85, No. 1/2, p 183-197, June 1986. 5 fig, 1 tab, 24 ref.

Descriptors: *Meteoric water, *Groundwater movement, *Isotope studies, *Nevada, *California, Model studies, Hydrologic budget, Rainfall-runoff relationships, Rainfall, Evaporation, Precipition, Deuterium.

The depletion of deuterium in surface and shallow groundwaters along a traverse through Northern California and Nevada was used to model the local hydrologic balance as controlled by the eastward flux of meteoric water in a way not possible by conventional methods. When plotted against distance from the Pacific Ocean, the data indicate three hydrologic provinces which differ in their relative degree of openess. Isotopic variations of groundwater in the first province are governed by Rayleigh distillation from the eastward-moving storm clouds. Some 40% of the storm water vapor precipitates out before reaching the California coast, and another 16*5 in the first 55 km across the continent. The isotopic depletion in the second hydrologic province is linear with distance, and this suggests extensive recycling of terrestrial water. The third province constitutes the Great Basin, characterized by the lack of significant hydrogen isotope variation of groundwater, is thought to be an isotopically closed system. The quantity of water crossing the coast calculated from a model that incorporates the Rayleigh distillation equation is approximately equal to the quantity of precipitation along the Northern California part of the transect studied. This illustrates the importance of evapotranspiration in the terrestrial water budget, as well as the dependency of inland areas on the eastward flux of recycled terrestrial water. (Author's abstract)
W87-02686

HYDRAULIC CONDUCTIVITY AND RELATED PHYSICAL PROPERTIES OF PEAT, LOST RIVER PEATLAND, NORTHERN MINNESOTA,
For primary bibliographic entry see Field 2G.
W87-02715

IMMISCIBLE CONTAMINANT TRANSPORT IN SOILS AND GROUNDWATER WITH AN EMPHASIS ON PETROLEUM HYDROCARBONS: SYSTEM OF DIFFERENTIAL EQUATIONS VS SINGLE CELL MODEL,
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W87-02729

RETARDATION OF TOXIC CHEMICALS IN A CONTAMINATED OUTWASH AQUIFER,
National Hydrology Research Inst., Ottawa (Ontario).
For primary bibliographic entry see Field 5B.
W87-02731

BIODEGRADATION OF METHANOL AND TERTIARY BUTYL ALCOHOL IN SUBSURFACE SYSTEMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W87-02732

IN SITU AEROBIC BIODEGRADATION OF AQUIFER CONTAMINANTS AT KELLY AIR FORCE BASE,
Air Force Engineering and Services Center, Tyndall AFB, FL.
For primary bibliographic entry see Field 5G.
W87-02754

AQUIFER TRANSMISSIVITY OF POROUS MEDIA FROM RESISTIVITY DATA,
Roorkee Univ. (India). Dept. of Earth Sciences.
For primary bibliographic entry see Field 7B.
W87-02837

EVOLUTION IN SPACE AND TIME OF AN ALLUVIAL AQUIFER UNDER THE EFFECT OF AN EXCEPTIONAL MULTI-YEAR DROUGHT (MEDITERRANEAN SHORE, HERAULT, FRANCE) (EVOLUTION SPATIO-TEMPORELLE D'UN AQUIFERE ALLUVIAL SOUS L'EFFET D'UNE SECHERESSE PLURIANNUELLE EXCEPTIONNELLE (LITTORAL MEDITERRANEEN, HERAULT, FRANCE)),
Montpellier-2 Univ. (France). Lab. d'Hydrogeologie.
J. C. Grillot, and M. Razack.
Journal of Hydrology JHYDA7, Vol. 82, No. 1/2, p 155-173, November 30, 1985. 9 fig, 22 ref.

Descriptors: *Alluvial aquifers, *Water quality, *Drought, *Hydrodynamics, *Chemical properties, Hydrology, Aquifers, Potentiometric level, Chlorides, Sulfates, Ions, Permeability, Clays, Adsorption, France.

The potentiometric-surface fluctuations and hydrochemical evolution of an alluvial aquifer located along the Mediterranean shore have been observed during a period including a multi-year drought. Chloride and sulfate ions were selected for this study because of proximity to the seashore as well as the local intensive polyculture which requires application of sulfur to more than 90% of the area. Two major conclusions were drawn from this study. First, water-level fluctuations indicate different hydrodynamical behavior of the aquifer, probably depending on vertical zoning of permeability. The alluvial aquifer behaves as multilayered with different permeabilities, which produces potentiometric distortions. Second, from a hydrochemical viewpoint, lagged dilution was observed for chloride and sulfate. The question of retention of the chloride by clays has not yet been clearly answered. Lagged dilution is interpreted as resulting from spatial variations of permeability of the reservoir rather than only from the geochemical nature of its heterogeneities. (Author's abstract)
W87-02838

ANALYSIS OF EARTH-TIDE-INDUCED GROUNDWATER FLOW IN EASTERN BOTSWANA,
Botswana Univ., Gaborone. Faculty of Science.
A. Gieske, and J. J. De Vries.
Journal of Hydrology JHYDA7, Vol. 82, No. 3/4, p 211-232, December 30, 1985. 7 fig, 16 ref, 2 append.

Descriptors: *Earth tides, *Groundwater movement, *Botswana, *Groundwater levels, *Model studies, *Hydrologic models, Aquifers, Shales, Fracture permeability, Compressibility, Hydraulic gradient, Flow characteristics, Fluid mechanics, Hydraulics, Dolomite, Rocks, Tides.

Earth-tide-induced groundwater level fluctuations with a maximum amplitude of 12 cm have been observed in a fractured shale aquifer in eastern Botswana. Comparison of the oscillations with the tidal variations in the gravity field of the earth revealed a remarkable phase advance of the groundwater tides relative to the earth tides. The phase shift ranges from 28 degrees (1 h) for the semi-diurnal frequency group to about 47 degrees (4 h) for the diurnal group of the tidal spectrum. A theoretical model is presented that attributes the marked amplitude to a high compressibility of the aquifer, and explains the positive phase shift through a periodic groundwater flow between the shale basin and the surrounding aquifers. The horizontal hydraulic gradient that causes this groundwater movement is assumed to be induced by the tidal strain differentiation between the compressible shale and the more rigid arenitic and dolomitic adjoining rocks. The magnitude of the generated groundwater flow is of the order of 14 cu m/h at the outer fringe of the area. The tidal dilatation in the center of the shale basin is about 30 times the theoretical value for homogeneous conditions. (Author's abstract)
W87-02840

ANALYSIS OF STOCHASTIC GROUNDWATER PROBLEMS. PART I: DETERMINISTIC PARTIAL DIFFERENTIAL EQUATIONS IN GROUNDWATER FLOW. A FUNCTIONAL-ANALYTIC APPROACH,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
S. E. Serrano, T. E. Unny, and W. C. Lennox.
Journal of Hydrology JHYDA7, Vol. 82, No. 3/4, p 247-263, December 30, 1985. 5 fig, 24 ref.

Descriptors: *Stochastic hydrology, *Groundwater movement, *Mathematical studies, *Partial differential equations, *Flow characteristics, Numerical analysis, Groundwater, Flow.

Functional-analytic theory is proposed for the analysis of the problem of deterministic partial differential equations of the type appearing in groundwater flow. Equations are treated as abstract evolution equations for elliptic partial differential operators in an appropriate functional Sobolev space, for which a strongly continuous semigroup exists. A semigroup solution was developed andits application to regional groundwater flow is indicated. The theoretical framework presented in Part I serves as introduction for the stochastic groundwater flow problem presented in Part II and gives a unified conception of the deterministic and the stochastic problem. The difficulties in deriving the semigroup for a particular partial differential operator are compensated by the economy and flexibility in finding solutions for the same system subject to different initial conditions, different boundary conditions, or different forcing function. (See also W87-02843 thru W87-02844) (Author's abstract)
W87-02842

ANALYSIS OF STOCHASTIC GROUNDWATER FLOW PROBLEMS. PART II: STOCHASTIC PARTIAL DIFFERENTIAL EQUATIONS IN GROUNDWATER FLOW. A FUNCTIONAL-ANALYTIC APPROACH,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
S. E. Serrano, T. E. Unny, and W. C. Lennox.
Journal of Hydrology JHYDA7, Vol. 82, No. 3/4, p 265-284, December 30, 1985. 5 fig, 54 ref.

Descriptors: *Stochastic hydrology, *Groundwater movement, *Mathematical studies, *Partial differential equations, *Flow characteristics, Numerical analysis, Groundwater, Flow.

Functional-analytic theory was used to analyze the problem of stochastic partial differential equations of the type appearing in groundwater flow. Equations are treated as abstract stochastic evolution equations for elliptic partial differential operators in an appropriate functional Sobolev space. Explicit forms of solutions were obtained by using a strongly continuous semigroup. The deterministic and the stochastic problem could then be treated under the same theoretical framework. Use of the theory was illustrated in an application to the solution of the stochastic analogue of a regional groundwater flow problem studied previously. Two cases were solved: the randomly forced and the randomly initiated equation. The solution was obtained by applying the properties of semigroups and expressing the Wiener process as an infinite basis in a Hilbert space composed of independent uni-dimensional Wiener processes with incremental variance parameters. The first two moments of the solution as well as sample functions for different cases were derived. (See also W87-02842 thru W87-02844) (Author's abstract)
W87-02843

ANALYSIS OF STOCHASTIC GROUNDWATER FLOW PROBLEMS. PART III: APPROXIMATE SOLUTION OF STOCHASTIC PARTIAL DIFFERENTIAL EQUATIONS,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
S. E. Serrano, T. E. Unny, and W. C. Lennox.
Journal of Hydrology JHYDA7, Vol. 82, No. 3/4, p 285-306, December 30, 1985. 5 fig, 55 ref.

Descriptors: *Stochastic hydrology, *Groundwater movement, *Mathematical studies, *Partial differential equations, *Flow characteristics, Numerical analysis, Groundwater, Flow.

Following the theory presented earlier in this series of articles, functional analysis theory and a formulation of the Ito's lemma in Hilbert spaces were outlined as a practical alternative to the problem of finding the equations satisfying the moments of a stochastic partial differential equation of the type appearing in groundwater flow. Very simple solutions of the moments equations can be obtained. The most important feature of the moments equations derived from Ito's lemma is that these deterministic equations can be solved by any analytical or numerical method available in the literature, permitting the analysis and solution of stochastic partial differential equations occurring in two-dimensional or three-dimensional domains of any geometrical shape. The method provides a rigorous bridge between the abstract-theoretical analysis of stochastic partial differential equations and computer-oriented numerical techniques. An illustrative example is provided. (See also W87-02842 thru W87-02843) (Author's abstract)
W87-02844

CONTINUOUS MONITORING OF 222RN CONCENTRATION IN UNCONFINED GROUNDWATER,
Kyoto Univ., Osaka (Japan). Research Reactor Inst.
For primary bibliographic entry see Field 5A.
W87-02847

MATHEMATICAL MODELLING FOR MULTI-AQUIFER GROUNDWATER BASINS,
Geological Survey of India, Calcutta.
S. P. Dasgupta, and A. B. Biswas.
Journal of Hydrology JHYDA7, Vol. 82, No. 3/4, p 381-392, December 30, 1985. 5 fig, 12 ref, append.

Descriptors: *Model studies, *Mathematical analysis, *Aquifers, *Groundwater basins, *Hydrologic models, Algorithms, Computer models, Computers.

The theoretical formulation of the steady state fluid potential of a basin is directly transferred to an algorithm with the help of Fourier transform and a sequence of recurring filter functions for the computation of a three-dimensional mathematical model of unconfined multi-aquifer groundwater basins having relatively simple geometry. The algorithm is programmable and produces a large volume of nodal values in considerably small CPU time. The memory requirement of the program is low, so that the computations can be carried out in a mini- or micro-computer system. The method may be a useful substitute to finite element technique in a number of cases with respect to economy, time, and technicalities. (Author's abstract)
W87-02848

MORPHOLOGY OF A SALINE GROUNDWATER BODY: ITS INVESTIGATION, DESCRIPTION AND POSSIBLE EXPLANATION,
Birmingham Univ. (England). Hydrogeology Section.
J. H. Tellam, J. W. Lloyd, and M. Walters.
Journal of Hydrology JHYDA7, Vol. 83, No. 1/2, p 1-21, January 15, 1986. 9 fig, 4 tab, 17 ref.

Descriptors: *Groundwater, *Saline water, *Saline groundwater, *Aquifers, *Chemical properties, Geophysics, Hydrology, Waste disposal, Morphology, Water resources development, Sandstones, Borehole geophysics, Interstitial water, Chlorides, Topography, Viscous flow, Flow, Groundwater movement, Mersey Valley, England.

Saline groundwater (up to at least 100 g/l chloride) occurs as a layer of variable thickness below fresh groundwater in the Permo-Triassic sandstones of the Lower Mersey Basin of northwestern England. A detailed investigation of the morphology of the saline water body was undertaken using modern and historical chemical data, surface geophysics, borehole geophysics, open hole depth sampling, and borehole core porewater analysis. Chloride concentrations at all sites showed a pattern of steady increase to depths of at least 320 m. The surface of the saline water body exhibits considerable topographic variation. Saline water occurs at highest elevations below the roughly east-west trending Mersey Valley where it approaches ground level, but declines in elevation both to the north and south. In the north, the saline 'interface' meets the rising base of the sandstone sequence at a depth of around 280 m. Results of chemical and viscous flow analogue studies suggest that this ridged topography can be explained in terms of flushing and regional upconing in response to low groundwater heads in the Mersey Valley. (Author's abstract)
W87-02849

SIMPLE APPROXIMATION FOR A MOVING INTERFACE IN A COASTAL AQUIFER,
Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
L. T. Isaacs, and B. Hunt.
Journal of Hydrology JHYDA7, Vol. 83, No. 1/2, p 29-43, January 15, 1986. 7 fig, 1 tab, 11 ref.

Descriptors: *Mathematical studies, *Groundwater movement, *Saline-freshwater interfaces, *Coastal aquifers, *Estimating equations, Interfaces, *Confined aquifers, Aquifers, Numerical analysis, Steady flow, Flow.

An approximate analytical solution for a moving interface in a confined coastal aquifer can be achieved by solving a nonlinear first-order partial differential equation. The solution, which assumes that flow approaching the interface changes discontinuously with time from one constant value to another, coincides with exact steady-flow solutions obtained from the Dupuit approximation at both t = 0 and t = infinity. Comparison with numerical solutions suggests that maximum errors of about 10% occur in the toe location for intermediate values of time and that the approximate solution tends to overestimate both the rate of advance and retreat of the toe. The approximation has a very simple form and, in contrast to numerical solutions, is easy to evaluate. The analytical approximation can probably be applied with confidence to an unconfined flow only when the sudden change in approaching flow rate occurs at distances from the interface toe that are not too great, since free-surface storage effects slow the movement of the flow rate change before its effects are felt downstream at the interface toe. (Author's abstract)
W87-02851

SALINE- VERSUS FRESHWATER CONTRIBUTION TO THE THERMAL WATERS OF THE NORTHERN JORDAN RIFT VALLEY, ISRAEL,
Geological Survey of Israel, Jerusalem.
A. Arad, and A. Bein.
Journal of Hydrology JHYDA7, Vol. 83, No. 1/2, p 49-66, January 15, 1986. 9 fig, 1 tab, 20 ref.

Descriptors: *Thermal water, *Jordan Rift Valley, *Israel, *Saline water, *Groundwater hydrology, *Geohydrology, *Geothermal studies, Temperature, Aquifers, Fluorite, Calcite, Solubility, Fluorine, Mixing, Model studies, Oxygen isotopes, Tracers, Groundwater, Heat balance, Hydrology, Geophysics, Chemical properties, Physical properties, Salinity.

Temperature and salinity differences between thermal waters at equal depths on both sides of Lake Tiberias, Israel reveal that the hotter eastern system consists of heated fresh groundwater, while the western system consists of heated saline groundwater. This difference seems to result in exceptional fluorine enrichment in the fresh-thermal carbonate aquifer through temperature-controlled equilibrium solubility of fluorite and calcite. Mixing models based on oxygen isotopic composition and other chemical parameters suggest two distant recharge areas for the Mezar-Hammat Gader thermal system, as well as a Rift Valley salinity source. Hydrogeological and chemical considerations, including oxygen and strontium isotopic ratios, suggest that heat in the western system is attained through circulation under a normal geothermal gradient, whereas in the eastern system, a higher than usual geothermal gradient controls the heat balance. (Author's abstract)
W87-02852

NEW ANALOGUE COMPUTER FOR THE STUDY OF PUMPING TESTS UNDER FALLING WATER-TABLE CONDITIONS,
British Geological Survey, Wallingford (England).
For primary bibliographic entry see Field 7B.
W87-02854

COMPARATIVE ANALYSIS OF TRANSMISSIVITY AND HYDRAULIC CONDUCTIVITY VALUES FROM THE AJALI AQUIFER SYSTEM OF NIGERIA,
Anambra State Univ. of Technology, Enugu (Nigeria). Dept. of Geological Sciences.
B. C. E. Egboka, and K. O. Uma.
Journal of Hydrology JHYDA7, Vol. 83, No. 1/2, p 185-196, January 15, 1986. 2 fig, 5 tab, 20 ref.

Descriptors: *Transmissivity, *Groundwater movement, *Permeability coefficient, *Nigeria, *Aquifer systems, *Groundwater, *Aquifer testing, Aquifers, Water resources development, Developing countries, Pumping tests, Statistical methods, Estimating equations, Geohydrology, Groundwater hydrology.

Methods of aquifer analysis were evaluated to find simple, inexpensive alternatives to pumping tests for estimating such parameters as hydraulic conductivity (K), transmissivity (T), and storativity (S). Three grain-size statistical methods and Logan's (1964) approximation method were used to calculate K and T for the aquifers of the Ajali Formation of Nigeria. The resulting data were compared with those of pumping-test methods where available. The Masch and Denny (1966) statistical method gave values that are as reliable and useful as Logan's and other pumping-test methods. The Hazen (1893) and Harleman et al (1963) statistical methods gave unreasonably high K and T values. (Author's abstract)
W87-02859

AIR ENCAPSULATION: I. MEASUREMENT IN A FIELD SOIL,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 2G.
W87-02915

AIR ENCAPSULATION: II. PROFILE WATER STORAGE AND SHALLOW WATER TABLE FLUCTUATIONS,
Battelle Pacific Northwest Labs., Richland, WA.
M. J. Fayer, and D. Hillel .
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 3, p 572-577, May-June 1986. 6 fig, 2 tab, 17 ref.

Descriptors: *Infiltration, *Air encapsulation, *Water table profiles, *Water storage, *Water table, Groundwater, Soil moisture, Mathematical modeling, Shallow water, Model studies, Water level fluctuations.

In a wet soil, volumetric encapsulated air contents can easily approach 0.06 cu m/cu m. The objective of this study was to determine, through simulation, the effect of air encapsulation on profile water storage and shallow water tablefluctuations, and whether air encapsulation should be considered in modeling field events. Using a two dimensional soil moisture code, profile water storage changes during hypothetical rainfall events and water table responses during actual rainfall events were simulated. Following the infiltration of 10 mm of water, profile moisture content differences with and without air encapsulation would be <0.01 cu m/cu m, and thus may not be measurable in the field with a neutron probe. Water table levels, rose significantly higher in the profile when air was encapsulated. The water table rises were two to five times those when air was not encapsulated. For water tables located within 1.3 m of the surface, application of the model to actual rainfall events improved the fit to the measured water table data. In those situations where water table level predictions are important (e.g., wetlands, streambanks), researchers should consider air encapsulation in their analysis of water table fluctuations. (See also W87-02915) (Author's abstract)
W87-02916

ESTIMATING MACROPOROSITY IN A FOREST WATERSHED BY USE OF A TENSION INFILTROMETER,
Tennessee Univ., Knoxville.
For primary bibliographic entry see Field 2G.
W87-02917

EFFICIENT RESPONSE MATRIX METHOD FOR COUPLING A GROUNDWATER SIMULATOR AND A REGIONAL AGRICULTURAL MANAGEMENT MODEL,
Safeway Stores, Inc., Oakland, CA.
For primary bibliographic entry see Field 4B.
W87-02936

EXAMINATION OF THE MECHANISMS CONTROLLING GROUNDWATER GRADIENTS IN HYPER-ARID REGIONAL SEDIMENTARY BASINS,
Birmingham Univ. (England). Dept. of Geological Sciences.
J. W. Lloyd, and J. C. Miles.
Water Resources Bulletin WARBAQ, Vol. 22, No. 3, p 471-478, June 1986. 12 fig, 1 tab, 14 ref.

Descriptors: *Arid lands, *Groundwater movement, *Groundwater recharge, *Sedimentary basins, *Groundwater models, *North Africa, *Arabia, *Recharge volume, Mathematical models, Aquifer, Flow mechanisms, Connate water, Confined aquifers, Hydrologic budget.

Evidence of modern recharge in the North African and Arabian sedimentary basin aquifers exists but it is difficult to determine the volume of recharge. The flow within the aquifers seems to be appreciably greater expected. A hypotethical model embodying the characteristics of the aquifers was used to investigate the likely significance of various possible flow mechanisms. It is seen that while dewatering in the unconfined area can possibly contribute to flows for a considerable period of time, the maintenance of water levels in the unconfined zone must be the result of modern recharge, and recharge depths of less than 10 mm/yr are sufficient given suitable aquifer parameters. Results for various combinations of aquifer parameters and configurations are given, including layered aquifers and the effects of restricted outflows. There is little point in carrying out conventional hydrological balance studies in hyper-arid areas; instead, more emphasis should be placed on good groundwater hydrographic data and modeling. (Author's abstract)
W87-02942

REGIME OF GROUND WATER OF SEMBERIAN AQUIFER,
Belgrade Univ. (Yugoslavia). Faculty of Agriculture.
J. Munir.
Aqua AQUAAA, No. 4, p 190-193, 1986. 5 fig.

Descriptors: *Semberian aquifer, *Yugoslavia, *Sava River, *Groundwater, *Alluvial aquifers, *Alluvial plain, *Drill holes, *Piezometry, *Rainfall, *Temperature, Dispersion, Correlation.

The Semberian aquifer of groundwater represents a large alluvial plain of the Sava River (Yugoslavia). Analysis of dispersion parameters, especially variation coefficients, indicates that the groundwater regime of the Semberian aquifer is relatively 'quiet' but distribution of all the factors influencing the groundwater regime is asymmetrical. There is a high correlation between the piezo drill holes in the vicinity of the Sava and its water level. The correlations of groundwater level with rainfall and temperature are very small. Complex correlations of groundwater with Sava River level, rainfall, and temperature show the same characteristics as the simple correlations. The values for the coefficients of complex correlation indicate that piezo drill holes near the Sava are exclusively under its impact. A long period is required for variations in Sava level to be observed on the groundwater levels of the areas surrounding the drill hole. (Rochester-PTT)
W87-03043

GROUNDWATER OCCURRENCES IN THE HARD ROCK TERRAINS OF SRI LANKA - A CASE STUDY,
Sri Lanka Univ., Peradeniya. Dept. of Geology.
H. A. H. Jayasena, B. K. Singh, and C. B. Dissanayake.
Aqua AQUAA, No. 4, p 214-219, 1986. 7 fig, 1 tab, 17 ref.

Descriptors: *Sri Lanka, *Geohydrology, *Geology, *Groundwater, *Aquifers, *Aquicludes, *Weathering, Kurunegala District, Crystalline rocks, Quartzite, Marble, Granites, Charnockites, Migmatites, Gray feldspar granitic rocks, Fractures, Biotite gneiss, Rivers, Water supply development, Paleochannels.

Preliminary observations are reported on the occurrence of groundwater in with respect to geology, structure and weathering of typical hard, crystalline rocks of the Kurunegala district of Sri Lanka. Geological materials such as quartzite, marble, and fractured granites are associated with the most productive aquifers, whereas charnockites, migmatites, and gray feldspar granitic rocks devoid of many fractures behave as aquicludes. One or more deep fractures, detected by remote sensing and drilling, were detected in addition to shallow saturated fracture zones. The thickness of the soil overburden is an important factor governing the availability and occurrence of shallow groundwater and, in the study area, the reddish soil development over horneblende biotite gneiss is fairly thick and produced a substantial amount of groundwater. Paleochannels beside major drainage courses also yielded appreciable amounts. Groundwater reservoirs are artificially recharged by man-made tanks in the dry zones of Sri Lanka; in certain northern dry lands, town water supply schemes are effectively implemented by tapping these reservoirs. (Author's abstract)
W87-03047

PETROLEUM RECOVERY OPERATIONS IN AN URBAN AREA,
New York State Dept. of Transportation, Hauppauge.
For primary bibliographic entry see Field 5G.
W87-03065

INTERPRETATION OF TRACER DATA IN VARIABLE FLOW SYSTEMS,
Institute of Physics and Nuclear Techniques, Krakow (Poland).
For primary bibliographic entry see Field 7B.
W87-03070

VERTICAL-HORIZONTAL TRANSPORT AND FATE OF LOW WATER SOLUBILITY CHEMICALS IN UNSATURATED SOILS,
Oregon State Univ., Corvallis. Dept. of Mathematics.
For primary bibliographic entry see Field 2G.
W87-03074

RESULTS OF PUMPING TESTS IN THE DECCAN TRAP BASALTS OF CENTRAL INDIA,
Geraghty and Miller, Inc., Hackensack, NJ.
V. W. Uhl, and V. G. Joshi.
Journal of Hydrology JHYDA7, Vol. 86, No. 1/2, p 147-168, September 1986. 12 fig, 3 tab, 16 ref.

Descriptors: *Pumping tests, *Basalts, *India, *Groundwater, Industrial water, Agricultural water, Aquifers, *Drawdown, Transmissivity, Specific capacity, Water resources development, Water supply, Test wells, Model studies, Water level.

In the Satpura Hills Region of Central India the past 14 years has seen development of groundwater resources for village, town, agricultural and industrial uses. To date, over 700 wells have been drilled in the basalt rocks and aquifer pumping tests have been run on more than 200 wells. As a result of controlled testing and detailed analysis of these pumping tests, it was possible to evaluate the applicability of standard analytical models for the analysis of pumping tests in basalt rock aquifers. Step drawdown pumping tests were run to determine the components of drawdown due to aquifer loss and well loss. Step test data were analyzed by two different methods. The results indicate that well losses comprise a significant component of drawdown in most wells, and that these losses are probably a result of non-Darcian flow in the aquifer adjacent to the pumped well. Constant rate pumping tests were run to determine aquifer transmissivity and specific capacity. Time drawdown dates were analyzed by Cooper-Jacob approximation to the Theis equation, and recovery data were analyzed by the residual drawdown method. Aquifer transmissivity ranged over 2 to 3 orders of magnitude from less than 10 sq m/day to more than 300 sq m/day. Pumping test results often enabled the prediction of aquifer conditions such as limited aquifers, recharge boundaries and aquifer dewatering. (Author's abstract)
W87-03076

COMPARISON OF THE COUPLED FRESH WATER-SALT WATER FLOW AND THE GHYBEN-HERZBERG SHARP INTERFACE APPROACHES TO MODELING OF TRANSIENT BEHAVIOR IN COASTAL AQUIFER SYSTEMS,
Geological Survey, Menlo Park, CA. Water Resources Div.
H. I. Essaid.
Journal of Hydrology JHYDA7, Vol. 86, No. 1/2, p 169-193, September 1986. 12 fig, 40 ref.

Descriptors: *Waialae aquifer, *Coastal aquifers, *Saline-freshwater interfaces, *Model studies, *Aquifer systems, *Ghyben-Herzberg principle, *Oahu, Storage, Boundary conditions, Transmissivity, Anisotropy, Elastic storage, Saline water intrusion, Encroachment, Hydraulic properties, Hydraulic head, Hawaii.

When pumpage is initiated in a fresh water lens with a sharp interface floating on salt water, the freshwater removed from the system comes from: (1) drainage from the water table; (2) drainage at the interface where freshwater is being replaced by salt water; and (3) water released due to elastic storage effects. A quasi-three dimensional finite difference model which simulates coupled, fresh water and salt water flow, separated by a sharp interface, was used to investigate the effects of storage characteristics, transmissivity, boundary conditions and anisotropy on the transient responses of such flow systems. The magnitude and departure of aquifer response from the behavior predicted using the Ghyben-Herzberg, one fluid approach is a function of the ease with which flow can be induced in the salt water region. In many common hydrogeologic settings short term fresh water responses, and transitional responses between short term and long term, can only be realistically reproduced by including the effects of salt water flow on the dynamics of coastal flow systems. The coupled fresh water-salt water flow modeling approach is able to reproduce the observed annual fresh water head response of the Waialae aquifer of southeastern Oahu, Hawaii. (Alexander-PTT)
W87-03077

SOURCES OF NITRATE TO GROUND WATER,
Wisconsin Univ.-Madison. Dept. of Soil Science.
For primary bibliographic entry see Field 5B.
W87-03130

TRITIUM CORRECTED 14C AND ATMOSPHERIC NOBLE GAS CORRECTED 4HE APPLIED TO DEDUCE AGES OF MIXED GROUNDWATERS: EXAMPLES FROM THE BADEN REGION, SWITZERLAND,
Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Isotope Research.
For primary bibliographic entry see Field 5A.
W87-03147

L37C-L35C VARIATIONS IN A DIFFUSION-CONTROLLED GROUNDWATER SYSTEM,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
For primary bibliographic entry see Field 5A.
W87-03149

LOCATION OF AN INTERFACE OBSERVATION WELL: A BAYESIAN APPROACH,
Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.
M. Ben-Zvi, and Y. Bachmat.
Water Resources Research WRERAQ, Vol. 22, No. 11, p 1503-1508, October 1986. 6 fig, 1 tab, 4 ref.

Descriptors: *Observation wells, *Bayesian method, *Saline water intrusion, *Groundwater management, *Saline-freshwater interfaces, Groundwater quality, Water quality control, Model studies, Mathematical models, Mathematical analysis.

Coastal aquifers are affected by intrusion of seawater. The depth of intrusion is often measured by the distance from the coastline to the toe of the seawater-freshwater interface. This paper considers the problem of estimating the location of the toe on the basis of prior information and of posterior information that can be obtained by adopting an interface model and installing an observation well. The solution to the problem involves decisions regarding the worthwhileness of drilling the well and its optimal location. A methodology is proposed for solving the problem by employing the Bayesian approach to decision making under uncertainty with the sum of expected risk and cost as the objective function. An alternative to installing a well may be the acquisition of additional prior information in order to reduce the prior range of uncertainty regarding the location of the toe. The problem then becomes one of making an optimal allocation of resources among competing alternatives. It is solved by comparing the expected net benefit from acquisition of prior information only against the net benefit from acquisition of prior information, adoption of an interface model, and installment of well. (Author's abstract)
W87-03187

TRANSPORT OF CONSERVATIVE TRACERS IN THE FIELD UNDER INTERMITTENT FLOOD IRRIGATION,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 2G.
W87-03191

FINITE-ELEMENT COLLOCATION METHOD FOR VARIABLY SATURATED FLOW IN TWO SPACE DIMENSIONS,
Wyoming Univ., Laramie. Dept. of Mathematics.
M. B. Allen, and C. L. Murphy.
Water Resources Research WRERAQ, Vol. 22, No. 11, p 1537-1542, october 1986. 4 fig, 12 ref.
NSF Grant Nos. CEE-8404266 and DMS-8504360.

Descriptors: *Saturated flow, *Groundwater movement, *Finite element method, *Collocation, Mathematical analysis, Mathematical equations, Porous media.

Introduced is a finite-element collocation technique for solving the equation governing two-dimensional flows in a variably saturated porous media. The scheme uses a mass-conserving formulation of Richard's equation as the basis for the finite-difference time-stepping method. Collocation in tensor-product spaces of Hermite cubics yields a computationally efficient finite-element approximation of the spatial derivatives. An area deserving further investigation, is the linear algebra involved at each iterative stage. Since the matrices for the multidimensional problems have an asymmetric block structure without diagonal dominance, better methods for solving the linear iterative systems would be a boon to further applications. A particularly promising approach along these lines advances an alternating-direction collocation scheme that reduces two-dimensional problems to sequences of one-dimensional problems. Given the efficiencies in matrix assembly already inherent in finite-element collocation, this general area of inquiry has the potential to make collocation even more competitive with Galerkin techniques. (Lantz-PTT)
W87-03192

GROUNDWATER SEEPAGE VECTORS AND THE POTENTIAL FOR HILLSLOPE FAILURE AND DEBRIS FLOW MOBILIZATION,

Cascades Volcano Observatory, Vancouver, WA.
R. M. Iverson, and J. J. Major.
Water Resources Research WRERAQ, Vol. 22, No. 11, p 1543-1548, October 1986. 9 fig, 14 ref, append.

Descriptors: *Groundwater movement, *Slope degradation, *Debris flow, Flow control, Mathematical analysis, Mathematical equations, Darcy's Law, Equilibrium.

Insight for understanding the effect of groundwater flow on the potential for hillslope failure and liquefaction is provided by a novel limit-equilibrium analysis of infinite slopes with steady, uniform Darcian seepage of arbitrary magnitude and direction. Normalization of the limit-equilibrium solution shows that three dimensionless parameters govern completely the Coulomb failure potential of saturated, cohesionless, infinite homogeneous hillslopes: (1) the ratio of seepage force magnitude to gravitational body force magnitude; (2) the angle theta - phi, where theta is the surface slope angle and phi is the angle of internal friction of the soil; and (3) the angle lambda + phi, where lambda is the angle of the seepage vector measured with respect to an outward-directed surface-normal vector. An additional dimensionless parameter affects the solution if soil cohesion is included in the analysis. Representation of the normalized solution as a single family of curves shows that minimum slope stability universally occurs when the seepage direction is given by lambda = 90 degrees - phi. It also shows that for some upward seepage conditions, slope stability is limited by static liquefaction rather than by Coulomb failure. Close association between these liquefaction conditions and certain Coulomb failure conditions indicates that slope failure in such instances could be responsible for nearly spontaneous mobilization of destructive flowing soil masses on hillslopes. (Author's abstract)
W87-03193

DETERMINISTIC AND STOCHASTIC ANALYSES OF DISPERSION IN AN UNBOUNDED STRATIFIED POROUS MEDIUM,
Auburn Univ., AL. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W87-03196

UPSTREAM WEIGHT MULTIPLE-CELL BALANCE FINITE-ELEMENT METHOD FOR SOLVING THREE-DIMENSIONAL CONVECTION-DISPERSION EQUATIONS,
California Univ., Los Angeles. Dept. of Civil Engineering.
C. Wang, N. Z. Sun, and W. W. G. Yeh.
Water Resources Research WRERAQ, Vol. 22, No. 11, p 1575-1589, October 1986. 14 fig, 2 tab, 21 ref. NSF Grant No. CEE 83-01230.

Descriptors: *Groundwater movement, *Path of pollutants, *Aquifers, *Finite element method, *Convection, *Dispersion, Mathematical equations, Solute transport, Mathematical analysis.

The three-dimensional nature of dispersion in natural groundwater systems and three-dimensional flow domains require a three-dimensional approach to solve the aquifer solute transport problem. A new numerical method has been developed for simulating the three-dimensional transport process in groundwater based on the concept of upstream weighting and multiple-cell balance. Triangular prism elements are used, and six invented nodes are added to each element. With the aid of these invented nodes, upstream weights that depend on the mesh Peclet number are directly added to the linear basis function, and can be used to simulate the transport problems with small, as well as large Peclet numbers. The method combines the concepts of local mass balance and finite-element approximations. When convective transport dominates the dispersive transport, the proposed technique effectively eliminates the oscillation of numerical solutions with only a nominal increase of formation effort over that of the general Galerkin finite-element method. Two numerical examples for which analytical solutions exist are used to verify the proposed numerical solutions. An additional example is presented to demonstrate the practical applicability of the proposed method. (Lantz-PTT)
W87-03197

NEW FORMULA FOR THE ANALYTICAL SOLUTION OF THE RADIAL DISPERSION PROBLEM,
Geological Survey, Menlo Park, CA. Water Resources Div.
P. A. Hsieh.
Water Resources Research WRERAQ, Vol. 22, No. 11, p 1597-1605, October 1986. 6 fig, 4 tab, 10 ref, 3 append.

Descriptors: *Solute transport, *Path of pollutants, *Tracers, *Radial dispersion, *Mathematical equations, Groundwater movement, Aquifers, Mathematical analysis, Flow patterns.

A new formula is presented for the analytical solution of the radial dispersion problem, which analyzes the dispersive transport of a tracer in radial flow from a recharge well. This formula is simpler than solutions presented by previous investigators, but the two solutions are shown to be equivalent. Because the analytical solution consists of an integral of an oscillatory function, it is evaluated as an alternating series, the terms of which are the integrals over successive half cycles of the integrand. An efficient algorithm is used to accelerate convergence of the series. The accuracies of previous solutions obtained by finite difference, numerical Laplace transform, and perturbation methods are examined by comparison with the analytical solution. Numerical values of the solution are tabulated for readers interested in checking the accuracies of solute transport codes. (Author's abstract)
W87-03199

DRAINS AS A BOUNDARY CONDITION IN FINITE ELEMENTS,
North Carolina State Univ. at Raleigh. Dept. of Biological and Agricultural Engineering.
G. Fipps, R. W. Skaggs, and J. L. Nieber.
Water Resources Research WRERAQ, Vol. 22, No. 11, p 1613-1621, October 1986. 12 fig, 5 tab, 18 ref.

Descriptors: *Boundary conditions, *Finite element methods, *Drains, *Model studies, *Groundwater movement, Hydraulic head, Drainage practices, Permeability coefficient, Mathematical analysis, Flow rates.

Four methods were selected for representing a drain in finite-element solutions of the Richards equation: (1) modeling a hole in the finite element mesh equal in size to the effective radius of the drain (M DRAIN); (2) using Kirkham's equation to specify the flux at a single nodal point representing the drain (KIRKEQ); (3) specifying the hydraulic head at the single node representing the drain (FIXED); and (4) applying a resistance adjustment method by adjusting the hydraulic conductivities of the elements around a single node representing the drain (VIMOKE). Differences in predictions of hydraulic heads and drain flow rates were found among the four methods. The selection of one of the four methods to represent the drain in a finite element grid should depend on the case considered, the kind of information needed, and on the amount of time one can devote to the task. The KIRKEQ approach is good for situations where only approximate water table levels and drain flow rates are needed. As a regularly spaced mesh may be used, time and expense is minimized. If a problem requires accurate prediction of hydraulic heads except in the immediate area around the drain and does not require the prediction of flow rates, the FIXED method using a modified mesh method is appropriate. For problems where both the hydraulic heads and flow rates are needed, the VIMOKE approach may be used. The chief advantage of using the M DRAIN approach is that hydraulic heads can be predicted accurately in the entire flow domain except at points in the immediate vicinity of the drain boundary. However, the time and cost required to generate grids and obtain the numerical solutions make this approach feasible only for systems containing a single or small number of drains. (Lantz-PTT)
W87-03201

REAL TIME WATER QUALITY FORECASTING MODELS BASED ON THE WATER QUANTITY/QUALITY RELATIONSHIP,
Vrije Univ., Brussels (Belgium). Lab. of Hydrology.
For primary bibliographic entry see Field 5A.
W87-03304

GROUNDWATER: ITS OCCURRENCE, MOVEMENT AND POTENTIAL FOR POLLUTION,
National Water Well Association, Worthington, OH.
J. H. Lehr.
IN: Proceedings of the Ohio Water Law Conference, December 6, 1983 Columbus, Ohio. 1983. p 1-12, 8 fig.

Descriptors: *Water quality, *Groundwater pollution, *Water pollution, Groundwater movement, Water supply, Water quality control.

There is approximately 9,000 cu km of controllable water in habitable areas of the world; three times that of what is presently used worldwide. What the world uses is 1,800 cu km in reservoirs or dams and another 1,200 in well fields; essentially all of the unused available water in the world is in the ground. Worldwide there is not a water problem, which of course does not help anybody in Kansas or Nebraska whose water table has dropped 800 ft and who cannot afford to pump it to grow their crops nor does it help those whose water is polluted. But there is still a lot of undeveloped groundwater. The physics of groundwater flow is presented. Further, assumptions about the ongoing sources and path of groundwater pollution indicate that 200,000 plumes have moved about a mile from their sources, polluting about 200 trillion gallons of water. To date, not 1% of the total water supply has been polluted, and through proper legislation, and public incentives, 98% of the water supply can remain unpolluted through the end of this century. (See also W87-03308) (Lantz-PTT)
W87-03309

MICROBIOLOGY OF SUBSURFACE ENVIRONMENTS.
Department of Energy, Washington, DC. Office of Energy Research.
Report No. DOE/ER-0264, (1986). Summary and Minutes of a Field Experimental Program Meeting at Savannah River National Laboratory on February 24 and 25, 1986. 12 p.

Descriptors: *Microbiological studies, *Subsurface environment, *Groundwater quality, *Conferences, Field tests, Microorganisms, Spatial distribution, Coring, Research priorities.

The overall research goal for the deep subsurface microbiological program was identified as: defining the nature of the microbial community in the subsurface environment. The types of information to be included - what is the density of microorganisms, the types, how deep, spatial distribution, comparison with surface microorganisms, and the relationship of the above to environmental/geochemical parameters, and the comparison to a contaminated site. Two program opportunities emerged at the meeting (1) a 'near term' research opportunity for research in the deep biosphere that takes advantage of SRL plans for deep coring; and (2) a 'long term' research opportunity building on a centralized site. Another objective discussed was the long term need which exists for a centralized research site, within which a series of collaborative, fundamental research investigations could be conducted. Specifically, the following were stressed: (1) a well characterized (source, geochemistry, hydrology, geology, and microbiology) site is required, (2) long term access and control are required, and (3) a nearby uncontaminated area (ideally a gradient of sites from uncontaminated to contaminated) is required. (Lantz-PTT)
W87-03325

2G. Water In Soils

UNSATURATED FLOW THROUGH SOLID WASTE LANDFILLS: MODEL AND SENSITIVITY ANALYSIS,
Rutgers - The State Univ., Piscataway, NJ. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5B.
W87-02628

EXAMINATION OF THE PENETRATION OF ENTERIC VIRUSES IN SOILS UNDER SIMULATED CONDITIONS IN THE LABORATORY,
Kongelige Veterinaer- og Landbohoejskole, Copenhagen (Denmark). Dept. of Veterinary Virology and Immunology.
For primary bibliographic entry see Field 5B.
W87-02663

ION-EXCHANGE RESIN SAMPLERS FOR THE IN-SITE MEASUREMENT OF MAJOR CATIONS IN SOILWATER SOLUTE FLUX,
Birmingham Univ. (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 7B.
W87-02678

HYDROLOGY OF A SLOPING, STRUCTURED CLAY SOIL AT WYTHAM, NEAR OXFORD, ENGLAND,
Helix Software Consultants, London (England). W. R. Kneale.
Journal of Hydrology JHYDA7, Vol. 85, No. 1/2, p 1-14, June 1986. 6 fig, 3 tab, 13 ref.

Descriptors: *Clays, *Soil hydrology, *Infiltration, *Soil properties, Catchments, England, Irrigation, Hydraulic properties, Hydraulic conductivity, Soil water, Soil property, Soil profile, Soil porosity.

A structured clay soil at a sloping site in the Wytham catchment near Oxford, England, was examined with the intention of establishing the route followed by water through the soil during rainfall. The hydraulic conductivity/matric potential relationship for wet soil was measured by the instantaneous profile method in the field and by steady-state measurements on soil cores. A series of experiments were performed in which controlled irrigation was applied to a field plot and the soil moisture content potential and outflow from a drain at the base of the plot were monitored. Intensities ranged between 3.6 and 15.6 mm h(-1). Moisture content and potential were also monitored at two undrained sites over a period of three and a half years. The observations made during the investigations demonstrated that macropore channels played an important role in the hydrology of the soil. (Author's abstract)
W87-02685

COMPARISON OF STEADY INFILTRATION SOLUTIONS FOR SPHERICAL CAVITIES UNDER SIMPLE VERSUS VARIABLE HYDRAULIC PROPERTIES,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
W. L. Hogarth, J. -Y. Parlange, and R. D. Braddock.
Soil Science SOSCAK, Vol. 142, No. 1, p 1-6, July 1986. 2 fig, 3 tab, 11 ref. Australian Research Grant scheme F8416177I.

Descriptors: *Infiltration, *Irrigation, *Hydraulic properties, Infiltration rate, Infiltration index, Hydraulic models, Fluid mechanics, Mathematical equations, Drip irrigation, Ditch irrigation.

The steady infiltration of water from a spherical cavity for simple versus variable hydraulic properties was analyzed. A numerical solution was developed for calculating flux across the cavity wall and compared with an earlier analytical result for simple hydraulic properties. Numerical results were also obtained for the flux for variable hydraulic properties. The comparison is used as a base to modify the analytical result and obtain a method for predicting the flux across the cavity wall in the case of variable hydraulic properties. This method appears to be very accurate for drip and ditch irrigation applications and shows that soil properties far from the source tend to dominate the flux across the cavity wall. (Author's abstract)
W87-02712

OBSERVATIONS OF SPATIAL VARIABILITY OF SOIL-WATER PRESSURE IN A FIELD SOIL,
Arizona Univ., Tucson. Dept. of Hydrology and Water Resources.
T.-C. J. Yeh, L. W. Gelhar, and P. J. Wierenga.
Soil Science SOSCAK, Vol. 142, No. 1, p 7-12, July 1986. 3 fig, 1 tab, 17 ref.

Descriptors: *Spatial distribution, *Soil pressure, *Moisture tension, Tensiometers, Monitoring, Prediction, Statistical analysis, Hydrologic properties, Stochastic hydrology.

Field variability of soil-water pressure along a 290-meter transect was observed. Pressures were measured with individual tensiometers which were monitored using a single, digital-readout pressure transducer that could be rapidly connected by inserting a hypodermic needle through the rubber stopper seal at the top of the tensiometer unit. Observations showed a gradual increase in soil water tension over time and a high degree of spatial variability. Covariance analysis of the pressure data showed that the variations were spatially correlated. Pressure variance increased with mean tension which agreed with predictions from stochastic theory. (Michael-PTT)
W87-02713

HYDRAULIC CONDUCTIVITY AND RELATED PHYSICAL PROPERTIES OF PEAT, LOST RIVER PEATLAND, NORTHERN MINNESOTA,
D. B. Chason, and D. I. Siegel.
Soil Science SOSCAK, Vol. 142, No. 2, p 91-99, August 1986. 7 fig, 45 ref.

Descriptors: *Permeability coefficient, *Groundwater movement, *Soil properties, *Peat bogs, *Minnesota, Peat soils, Piezometers, Statistical analysis, Density, Humification, Decomposing organic matter, Soil profiles.

Hydraulic conductivity, bulk density and humification of peat in three soil profiles at a spring fen-raised bog complex were measured. Piezometers were installed at a raised bog, its external fen margin and an adjacent spring fen. Hydraulic conductivity was determined by time-lag methods. Hydraulic conductivity determined for partially decomposed peat deeper than one meter was two to six times greater than previously reported in literature, and there appeared to be little correlation between depth and hydraulic conductivity. Laboratory analysis of peat cores showed that the ratio of horizontal to vertical hydraulic conductivity is highly variable throughout the peat column, with horizontal hydraulic conductivity generally one to two orders of magnitude greater than the vertical. Bulk density values were similar to those found in other moderately decomposed Minnesota peats. Bulk density and humicity did not statistically correlate with depth or hydraulic conductivity in the Lost River peats. It is suggested that humified peat can transmit groundwater more rapidly than previously thought and that interaction between groundwater in the peat and associated surface waters can be significant. (Michael-PTT)
W87-02715

INFLUENCE OF SOIL STRUCTURE ON MOVEMENT RATE OF SALTS THROUGH SOILS,
Oklahoma Agricultural Experiment Station, Stillwater.
For primary bibliographic entry see Field 5B.
W87-02716

PERCOLATION OF WATER BELOW AN IRRIGATED FIELD,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 5B.
W87-02722

SOIL-WATER DETERMINATION USING FIBER OPTICS,
North Dakota State Univ., Fargo.
R. S. Alessi, and L. Prunty.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 4, p 860-863, July-August 1986. 3 fig, 2 tab, 7 ref.

Descriptors: *Soil water, *Fiber optics, *Measuring instruments, Regression analysis, Desorption, Light penetration.

Measurements were made using a modified Tempe cell and a very fine sandy loam soil to determine if light transmission through an optical fiber surrounded by porous media decreased as water content in the media increased. Light transmission through a 1.0 mm diameter quartz rod was consistently related to the water status of the surrounding soil. Increased soil water resulted in decreased light transmission. The major components of the measurement system included a quartz rod, a light-emitting diode, a phototransistor, fiber optic cable and connectors. Increasing levels of air pressure were applied at the Tempe cell inlet and drainage volume and instrument voltage were recorded at equilibrium. Data were separately analyzed with pressure and volumetric water content as independent variables. Voltage was highly significant with both variables and there was no significant difference between slopes or intercepts of regression lines across repeated desorption cycles. It was concluded that this soil water measurement technique is feasible and deserves further research. (Author's abstract)
W87-02723

PREFERENTIAL FLOW AND HYDRAULIC CONDUCTIVITY OF FOREST SOILS,
Commonwealth Scientific and Industrial Research Organization, Canberra (Australia). Div. of Water and Land Resources.
I. D. Moore, G. J. Burch, and P. J. Wallbrink.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 4, p 876-881, July-August 1986. 4 fig, 2 tab, 20 ref.

Descriptors: *Permeability coefficient, *Soilwater movement, *Preferential flow, *Hydraulic conductivity, *Forest soils, Mathematical equations, Density, Soil porosity, Hydraulic properties, Analytical methods, Hydraulic permeability.

Macroscopic analytical methods based on the capillary rise formula and the Hagen-Poiseuille equation were used to represent the combined effects of soil pore size and preferential flow on the hydraulic conductivity of forest soils. A density function was derived that relates effective pore diameters of heterogeneous systems to hydraulic conductivity. Density functions derived for soils from sites with different topographic features and disturbance effects characterized the effect of preferential flow on their hydraulic conductivity. If hydraulic conductivity and equivalent pore size of the undisturbed parent soil have been characterized, macroscopic methods can be used to predict the effect of disturbance on the the hydraulic behavior of forest soils without reliance on microscopic examination of individual pores. (Author's abstract)
W87-02724

INFILTRATION AND WATER EXTRACTION FROM TRICKLE IRRIGATION SOURCE: THE EFFECTIVE HEMISPHERE MODEL,
Ben-Gurion Univ. of the Negev, Sde Boker (Israel). Jacob Blaustein Inst. for Desert Research.
J. Ben-Asher, C. Charach, and A. Zemel.
Soil Science Society of America Journal SSSJD4, Vol. 50, No 4, p 882-887, July-August 1986. 5 fig, 2 tab, 14 ref.

Descriptors: *Infiltration, *Trickle irrigation, *Hydraulic models, Wetting, Saturation, Discharge,

Extraction, Mathematical models, Mathematical equations.

Infiltration from a point trickle irrigation source in the presence of water extraction was investigated using an approximate hemisphere model. Analytic expressions were derived for the wetting front position. In the short term, the advance of the wetting front depends on a single soil parameter that is closely related to saturated water content. At longer periods, water extraction effects modify the solution to an exponential approach to a limiting radius which is determined by the balance between the competing discharge and extraction processes. Results are consistent with available experimental data (for Yuma sand dunes, Panoche clay loam, fine sandy loam and Bet Dagan clay soil) and with predictions of existing models. (Author's abstract)
W87-02725

SPATIAL VARIABILITY AND SOIL SAMPLING FOR SALINITY AND SODICITY APPRAISAL IN SURFACE IRRIGATED ORCHARDS,
Texas A and M Univ., El Paso. Agricultural Research Station.
S. Miyamoto, and I. Cruz.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 4, p 1020-1026, July-August 1986. 4 fig, 6 tab, 13 ref.

Descriptors: *Saline soils, *Sampling, *Orchards, *Soil chemistry, *Texas, *Salinity, *Surface irrigation, *Sodicity, Saturation, Frequency distribution, Spatial distribution, Soil water.

Salinity and sodicity variation at five Texas pecan orchards were examined to develop soil sampling schemes for salinity appraisal. Fields had been irrigated by border or basin methods. Salinity and sodicity of the saturation extract varied widely in samples collected in a systematic grid. The semivariogram of soil salinity and sodicity along transects or within mapping units did not reveal spatial structure, but were closely related to saturation water contents of the soils. Variation greatly decreased when stratified by mapping unit. Frequency distribution of salinity along transects was skewed, but when grouped by mapping unit and averaged over a depth, both salinity and sodicity readings followed a normal distribution. For routine salinity appraisal in relatively small, surface irrigated orchards, soil map-based samplings may be more efficient than those based on arbitrary transects or grid. (Michael-PTT)
W87-02726

ESTIMATING GENERALIZED SOIL-WATER CHARACTERISTICS FROM TEXTURE,
Agricultural Research Service, Pullman, WA.
K. E. Saxton, W. J. Rawls, J. S. Romberger, and R. I. Papendick.
Soil Science Society of America Journal SSSDJ4, Vol. 50, No. 4, p 1031-1036, July-August 1986. 6 fig, 2 tab, 17 ref.

Descriptors: *Soil water potential, *Soil texture, *Estimating equations, *Permeability coefficient, Statistical analysis, Mathematical equations, Multivariate analysis.

Measurements of soil-water potential and hydraulic conductivity relationships with soil-water content are costly, difficult and often impractical. General estimates based on more readily available information such as soil texture may be adequate for most purposes. Recent studies have developed statistical correlations between soil texture and soil potential and hydraulic conductivity. These results were extended by providing equations for continuous estimates over a broad range of soil texture, water potential and hydraulic conductivities. Results of recent statistical studies are were used to calculate water potential for a wide range of soil textures which are fit by multivariate analysis to provide continuous potential estimates for all inclusive textures. Equations were also developed for unsaturated hydraulic conductivities of all inclusive textures. Soil texture can be used as a calibration parameter where field or laboratory soil water characteristic data is available. Predicted values were successfully compared with several independent measurements of soil-water potential. (Author's abstract)
W87-02727

WATER SORPTION CHARACTERISTICS OF ALUMINUM- AND CALCIUM-SATURATED SOIL CLAYS,
Kentucky Agricultural Experiment Station, Lexington. Dept. of Agronomy.
A, D. Karathanasis, and V. P. Evangelou.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 4, p 1063-1068, July-August 1986. 5 fig, 4 tab, 29 ref.

Descriptors: *Sorption, *Aluminum, *Calcium, *Saturated soils, *Clays, Bentonite, Mineralogy, Enthalpy, Moisture retention, Acidic soils, Water vapor pressure, Interstitial volume, Saturation, Drought.

Water sorption by Al- and Ca-saturated bentonites and soil clays were quantitatively evaluated by thermogravimetry and differential scanning calorimetry techniques. After a 14-day equilibration, Al-saturated clays adsorbed less water than Ca-saturated at low water vapor pressures. Heats of dehydration followed similar trends, but the enthalpy required to remove one gram of water from either type was approximately equal for clays with similar mineralogy. Enthalpy decreased with decreasing interlayer space availability reaching minima in kaolinitic clays. Moisture retention differences were attributed to structural organization differences in the water molecule-exchangable cation network in the interlayer space and differential expansion at higher hydration states. The implications of these relationships may be higher field moisture capacities, higher moisture retention during drought and poorer field expression of cracks in acid soil with a relatively high degree of Al-saturation, particularly where the soil contains signficant quantities of montmorillonite. A significant dependence of soil moisture on the degree of Al saturation of the clay surface was indicated in 35 acid soil samples tested. (Michael-PTT)
W87-02728

IMMISCIBLE CONTAMINANT TRANSPORT IN SOILS AND GROUNDWATER WITH AN EMPHASIS ON PETROLEUM HYDROCARBONS: SYSTEM OF DIFFERENTIAL EQUATIONS VS SINGLE CELL MODEL,
Delaware Univ., Newark. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W87-02729

SORPTION OF HYDROPHOBIC TRACE ORGANIC COMPOUNDS IN GROUNDWATER SYSTEMS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
For primary bibliographic entry see Field 5B.
W87-02730

TRANSPORT OF SOLUTES IN SOIL: BASIC FEATURES OF FRONT RETARDATION,
Agricultural Univ., Wageningen (Netherlands). Dept. of Soil Science and Geology.
For primary bibliographic entry see Field 5B.
W87-02733

TERMINATION CRITERIA FOR CLAY PERMEABILITY TESTING,
Duke Univ., Durham, NC. Dept. of Civil and Environmental Engineering.
J. J. Peirce, and K. A. Witter.
Journal of Geotechnical Engineering (ASCE) JGENDZ, Vol. 112, No. 9, p 841-854, September 1986. 7 fig, 4 tab, 19 ref.

Descriptors: *Permeability coefficient, *Clays, *Statistical analysis, *Soil physical properties, *Soil porosity, *Soil properties, Soil water, Porosity, Mathematical studies, Statistics, Statistical methods, Saturation, Calcium sulfate, Landfills, Waste disposal, Permeability, Regression analysis.

The use of clay liners at hazardous waste disposal sites has prompted an interest in the hydraulic conductivity (k) of clays exposed to chemicals. This parameter is commonly determined in the laboratory using fixed or flexible wall permeameters and consolidometers, but past and current procedures reflect a lack of consistency in termination criteria for such tests. Linear regression and related statistical techniques are used to analyze k data, and test termination criteria are suggested. These criteria include that the slope of k versus pore volumes does not differ significantly from zero and that a minimum number of permeant pore volumes pass through the clay to provide saturation. Specific characteristics of the clay/chemical combination (e.g., cation exchange capacity) are not considered in order to simplify the presentation. Fixed wall permeameters are used to study the effects of calcium sulfate and two simulated waste chemicals on three field clays. Results indicate the usefulness of the analysis in defining equilibrium conditions and in laboratory testing. (Doria-PTT)
W87-02788

EFFECT OF CULTIVATED AND WILD RICE VARIETIES ON THE NITROGEN BALANCE OF FLOODED SOIL,
Boyce Thompson Inst. for Plant Research, Ithaca, NY.
For primary bibliographic entry see Field 2I.
W87-02813

VERTICAL TRANSPORT AND FATE OF LOW-WATER-SOLUBILITY CHEMICALS IN UNSATURATED SOILS,
Oregon State Univ., Corvallis. Dept. of Mathematics.
For primary bibliographic entry see Field 5B.
W87-02836

NON-DARCIAN TRANSMISSION OF WATER IN CERTAIN HUMIFIED PEATS,
Dundee Univ. (Scotland). Dept. of Mechanical Engineering.
J. Waine, J. M. B. Brown, and H. A. P. Ingram.
Journal of Hydrology JHYDA7, Vol. 82, No. 3/4, p 327-339, December 30, 1985. 6 fig, 3 tab, 17 ref.

Descriptors: *Non-Darcian flow, *Newtonian flow, *Groundwater movement, *Permeability coefficient, *Transmission constant, *Peat, *Flow characteristics, Seepage, Hydraulic gradient, Hydrology, Fluid mechanics, Mathematical studies, Flow, Temperature effects.

Laboratory permeameter tests were conducted on moderately humified peat samples to investigate apparent non-Darcian flow behavior previously reported from seepage tube experiments. The tests were carried out for hydraulic gradients ranging from 1.5 to 17.5. The mean head could be varied independently. Seepage velocity was found to increase more than proportionally with hydraulic gradient. A flow relationship of the Swartzendruber type fitted the data, which showed a tendency for the apparent hydraulic conductivity to approach a limiting value at large hydraulic gradients. Subsequent investigations suggested a slight influence of mean head on hydraulic conductivity at constant hydraulic gradient, showed the mire water to be essentially Newtonian, and established that the non-Darcian behavior is insensitive to temperature. (Author's abstract)
W87-02846

EXPLICIT SOLUTION OF THE MODIFIED HORTON EQUATION,
University of the Witwatersrand, Johannesburg (South Africa). Water Systems Research Programme.
I. R. A. Green.
Journal of Hydrology JHYDA7, Vol. 83, No. 1/2, p 23-27, January 15, 1986. 1 fig, 6 ref.

Descriptors: *Infiltration capacity, *Horton equation, *Soil science, *Mathematical studies, *Infiltration rate, *Rainfall intensity, Computers, Hydrology, Rainfall infiltration.

A method for a direct solution of an integrated form of the Horton equation is described. The equation can be used to account for periods during which the prevailing infiltration rate exceeds rainfall intensity. An iterative or direct solution of the Horton equation is possible in this form. The method is explicit and, therefore, preferable to an iterative solution of an implicit equation, especially when program execution time on a microcomputer is of significance. (Author's abstract)
W87-02850

ALGORITHM FOR COMPUTING THE RELATIONSHIP BETWEEN DIFFUSIVITY AND SOIL MOISTURE CONTENT FROM THE HOT AIR METHOD,
Utrecht Rijksuniversiteit (Netherlands). Dept. of Physical Geography.
J. A. Van den Berg, and T. Louters.
Journal of Hydrology JHYDA7, Vol. 83, No. 1/2, p 149-159, January 15, 1986. 7 fig, 8 ref.

Descriptors: *Diffusivity, *Soil water movement, *Evaporation, *Mathematical studies, Computer programs, Computers, Algorithms, Fortran, Boundary conditions, Drying.

The hot air method for determining the relationship between diffusivity and soil moisture content uses a graphical procedure that is time-consuming and subjective; results obtained by different observers vary greatly. An algorithm is proposed by which the diffusivity values can be computed reproducibly, using an empirical function with four parameters. Two of these are ascertained by the boundary conditions, while the other two have been optimized by a standard procedure. The computation is rapid and unambiguous. The algorithm also enables an analytical expression for the evaporation generated by the drying of a sample by hot air, providing a reliable judgment of the appropriateness of the data obtained. The method has been tested on residual, silty soils. A program in FORTRAN 77 is available upon request. (Author's abstract)
W87-02856

COMBINED EFFECT OF HYSTERESIS AND TEMPERATURE ON SOIL-WATER MOVEMENT,
Auburn Univ., AL. Dept. of Agronomy and Soils.
J. W. Hopmans, and J. H. Dane.
Journal of Hydrology JHYDA7, Vol. 83, No. 1/2, p 161-171, January 15, 1986. 4 fig, 16 ref, append.

Descriptors: *Hysteresis, *Soil water, *Soil water movement, *Temperature effects, Hydraulics, Simulation, Boundary conditions, Hydraulic properties, Pressure head, Fluctuations, Soil properties, Soil surfaces, Flow, Flow characteristics, Hydrology.

The effects of temperature and hysteresis are often ignored in soil-water movement studies. To investigate the validity of this approach, soil-water movement in the vertical direction was simulated for different temperature regimes and boundary conditions while incorporating hysteresis. Corrections of the soil hydraulic properties due to temperature changes and hysteresis were based on existing theories. The effects of both temperature and hysteresis depend on the type of boundary condition applied. Water content profiles were affected more by varying temperatures and/or hysteresis for a pressure head boundary condition than for a flux boundary condition at the soil surface. However, hysteresis tended to dominate temperature effects during the simulation of water movement. (Author's abstract)
W87-02857

DISTRIBUTION FUNCTION APPROACH TO WATER FLOW IN SOIL MACROPORES BASED ON KINEMATIC WAVE THEORY,
Virginia Univ., Charlottesville. Dept. of Environmental Sciences.
P. F. Germann, and K. Beven.
Journal of Hydrology JHYDA7, Vol. 83, No. 1/2, p 173-183, January 15, 1986. 3 fig, 1 tab, 16 ref.
NSF Grant CEE-8401245; EPA Contract 4B 1077 NAEX.

Descriptors: *Soil water, *Pores, *Kinematic wave theory, *Mathematical studies, *Gravity flow, Hydraulics, Distribution, Flow, Frequency distribution, Drainage, Hydrographs, Soil types, Measuring instruments, Hydrology, Conductance, Rainfall, Groundwater, Water table, Pollution protection, Sorption.

Kinematic wave theory was adapted to gravity-driven flow in narrowly defined macropore groups. The frequency distribution of macropore conductance is obtained by superimposing the predicted drainage hydrographs from the individual groups of macropores and matching predicted outputs to observed drainage hydrographs. The time period over which this concept applies is limited to about 1.5 times the duration of the water input to the soil surface. The drainage hydrographs from four different soils were analyzed using three different measuring devices. Results suggest that between 0.01 and 0.2 of the input is required to supply water to the macropore system, while a parameter controlling losses to the matrix varies over only a small range. Macropore flow stages I and II can occur under natural rainfall conditions down to soil depths of more than 2.0 m, indicating that any groundwater table at about this depth can be replenished significantly by macropore flow, possibly depriving the groundwater of pollution protection due to the chemical sorbing capacity of the soil matrix. This effect may be enhanced by the capillary fringe above the water table. (Author's abstract)
W87-02858

SOIL POTENTIAL RATINGS FOR ONSITE WASTEWATER DISPOSAL,
Satterthwaite Associates, Inc., West Chester, PA.
For primary bibliographic entry see Field 5E.
W87-02860

EFFECT OF SOIL AND EFFLUENT CHARACTERISTICS ON PHOSPHORUS SORPTION IN DOSED COLUMNS,
British Columbia Ministry of Environment, Victoria.
N. K. Nagpal.
Journal of Environmental Quality JEVQAA, Vol. 15, No. 1, p 73-78, January-March 1986. 4 fig, 4 tab, 14 ref.

Descriptors: *Soil properties, *Path of pollutants, *Soil disposal fields, *Effluents, *Soil columns, *Phosphorus, *Solute transport, *Fate of pollutants, Nutrients, Sorption, Flow, Chemical properties, Soil types, Soil properties, Pore size, Pores, Hydraulic loading, *Septic tanks, Wastewater disposal, Leaching.

The effects of soil and effluent loading characteristics on long-term phosphorus retention and movement in soil columns were investigated. Three effluent treatments were used that varied in P concentration and hydraulic loading levels. The soils were kept unsaturated. Continued effluent loading resulted in P breakthrough and a decrease in P sorption by soils. P sorption by soils reached equilibrium in five of six columns. Both pore volume at P breakthrough (PVBT) and P sorption at equilibrium (PSEQ) appeared to be affected by the preferential movement of effluent through macropores. Irrespective of the mode of effluent flow, an increase in effluent P concentration and hydraulic loading decreased PSEQ, regardless of the mode of effluent flow. The effect of hydraulic loading on PSEQ was, however, more pronounced. Doubling the P loading through an increase in effluent P concentration decreased PSEQ by 2% to 11%. However, a similar increase in P loading obtained by a two-fold increase in hydraulic loading decreased PSEQ by 12% and 34% in Rosewall and Qualicum soils, respectively. A strong influence of effluent flow rate on PVBT masked any effect of soil type and effluent loading on PVBT. The implications of these results with respect to wastewater renovation capability of a septic tank drainfield were discussed. (Author's abstract)
W87-02861

SOIL APPLICATION OF A HYDROPHILIC CONDITIONER IN RELATION TO MOISTURE, IRRIGATION FREQUENCY AND CROP GROWTH,
American Univ., Beirut (Lebanon).
For primary bibliographic entry see Field 3F.
W87-02881

EFFECTS OF SOIL CONDITIONERS ON WATER RELATIONSHIPS IN SOILS,
California Univ., Los Angeles. Lab. of Biomedical and Environmental Sciences.
A. Wallace, G. A. Wallace, and A. M. Abouzamzam.
Soil Science SOSCAK, Vol.141, No. 5, p 346-352, May 1986. 5 tab, 25 ref. U.S. Department of Energy Contract No. DE-ACO3-76-SF00012.

Descriptors: *Soil-water-plant relationships, *Soil conditioners, *Soil water, *Polymers, Soil treatment, Soils, Soil moisture retention, Permeability, Capillary water, Infiltration.

Highly promising procedures are suggested to avoid loss of irrigation water from runoff and excessive evaporation, by increased water permeability of soil and a mulch-like effect of the surface-stabilized soil aggregates, large enough to decrease the upward capillary rise of water. The idea was to test the hypothesis that water infiltration characteristics of soil can be improved by the application of a solution to soil surfaces of 10 or fewer kilograms per hectare of high-molecular-weight polymers. Such improvements could have economic importance. Synthetic soil conditioners were shown to improve properties of soil related to water usage. Results today can be obtained with much lower concentrations of new polymers. An application of 26 mm of irrigation water containing 0.5 mg/L polymer would add 0.38 kg/ha of polymer; 5 mg/L would add 3.8 kg. Either application rate would be an economical means of soil improvement. One reason for low rates is application of polymers in the irrigation water, in contrast to the procedure of application of dry powder to soil 30 years ago. Low concentrations of polymers in the irrigation water increase water penetration into soils with different soils needing different concentrations. (Khumbatta-PTT)
W87-02910

POLYACRYLAMIDE APPLICATION IN IRRIGATION WATER TO INCREASE INFILTRATION,
Agricultural Research Service, Brawley, CA. Irrigated Desert Research Station.
A. R. Mitchell.
Soil Science SOSCAK, Vol. 141, No. 5, p 353-358, May 1986. 3 fig, 1 tab, 24 ref.

Descriptors: *Polyacrylamide, *Irrigation water, *Irrigation practices, *Infiltration, Permeability, Irrigation, Clay, Loam, Soil water, Polymercs, Soil moisture retention, Silt.

Many irrigated soils in the desert Southwest have a characteristic low hydraulic conductivity, which results in substantial economic consequences, such as problems of inadequate moisture, inefficient water use, and plant injury due to water ponding and salinity. In general, hydraulic conductivity is a function of pore volume, pore size, and geometry. Soil has been treated with polymers to improve its physical structure by binding aggregates on long-chain molecules. Polyacrylamide was tested on furrow irrigated cotton to assess its ability to improve infiltration on a Holtville silty clay loam (50% clay fraction consisting of 45% montmorillonite). Application was more effective as a dilute solution in irrigation water than as a dry powder on the soil surface. Solution concentrations of 25, 50 and 150 mg/L were tested; the highest amount increased the infiltration rate of subsequent irriga-

tions by 30 to 57% during the first 4 hours. The final infiltration rate after 12 hours, and total water infiltrated, were not increased by this application, indicating that surface sealing is not a limiting factor to the permeability of soils with a high fraction of swelling clay. (Khumbatta-PTT)
W87-02911

TRANSPORT AND LOSS OF NITROUS OXIDE IN SOIL WATER AFTER FOREST CLEAR-CUTTING,
Yale Univ., New Haven, CT. School of Forestry and Environmental Studies.
For primary bibliographic entry see Field 5B.
W87-02912

TEMPERATURE DEPENDENCE OF SOIL WATER RETENTION CURVES,
Auburn Univ., AL. Dept. of Agronomy and Soils.
J. W. Hopmans, and J. H. Dane.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 3, p 562-567, May-June 1986. 7 fig, 2 tab, 15 ref.

Descriptors: *Infiltration, *Soil water, *Soil moisture retention, *Temperature effects, *Mathematical studies, Surface tension, Temperature, Soil aeration, Soil water potential, Loam, Graphical analysis.

Effects of entrapped air volume and surface tension of soil solution are often regarded as the main cause of temperature effects on the water retention curve. A procedure was developed to determine simultaneously the water characteristic curves and the volume of entrapped air, for a glass beads medium and a Norfolk sandy loam at two temperatures. The volume change of entrapped air was determined from the change in volume of the free gas phase and the volume of water outflow from or inflow into a pressure cell. A decrease in entrapped air volume with increasing temperature and suction was seen. Surface tension values, calculated from capillary height measurements, showed the temperature coeffecient of surface tension of the soil solution to be smaller in magnitude than that of pure water. Neither changes in entrapped air volume nor the temperature coefficient of surface tension of the soil solution, could account for the temperature effect on experimentally determined water characteristic curves of the porous media. (Author's abstract)
W87-02914

AIR ENCAPSULATION: I. MEASUREMENT IN A FIELD SOIL,
Battelle Pacific Northwest Labs., Richland, WA.
M. J. Fayer, and D. Hillel.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 3, p 568-572, May-June 1986. 7 fig, 1 tab, 16 ref.

Descriptors: *Air encapsulation, *Field tests, *Soil aeration, *Measurement, *Infiltration, Water table, Sprinkling, Shallow water, Porosity.

Encapsulated air is an important component of shallow water table fluctuations. The aim of this study was to measure the quantity and persistence of encapsulated air in a field setting. Using sprinkling rates of either .0000035 or .000038 m/s, the water table in a field soil was brought from a depth of 1.5 m to the surface on several occasions. Moisture contents during and after sprinkling were monitored with a neutron probe. Twice, following sprinkling, the water table was maintained at the surface for more than 20 days, during which time monitoring of moisture contents continued. With the water table at the surface, differences between porosity and measured water content were attributed to encapsulated air, which ranged from 1.1 to 6.3% of the bulk soil volume, depending on the rate of sprinkling, soil depth, and initial soil moisture content. During ponding, encapsulated air persisted at the 0.3 m depth for up to 28 days. The results indicated that encapsulated air is measurable in a field situation and that its quantity and persistence should be considered in analyzing the results of similar field experiments. (See also W87-02916) (Author's abstract)
W87-02915

AIR ENCAPSULATION: II. PROFILE WATER STORAGE AND SHALLOW WATER TABLE FLUCTUATIONS,
Battelle Pacific Northwest Labs., Richland, WA.
For primary bibliographic entry see Field 2F.
W87-02916

ESTIMATING MACROPOROSITY IN A FOREST WATERSHED BY USE OF A TENSION INFILTROMETER,
Tennessee Univ., Knoxville.
K. W. Watson, and R. J. Luxmoore.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 3, p 578-582, May-June 1986. 5 fig, 2 tab, 19 ref.

Descriptors: *Macroporosity, *Forest watersheds, *Tension infiltrometer, *Soil properties, Poiseuille equation, Infiltration, Spatial variability, Groundwater basins, Measuring instruments, Capillary capacity, Mathematical equations, Watersheds, Ponding, Groundwater movement.

The ability to obtain sufficient field hydrologic data at reasonable cost can be an important limiting factor in applying transport models. A procedure is described for using ponded-flow- and tension-infiltration measurements to calculate transport parameters in a forest watershed. Thirty infiltration measurements were taken under ponded-flow conditions and at 3, 6, and 15 cm(H20) tension. Pores greater than 0.1, 0.05, and 0.02 cm diameter, respectively, were excluded from the transport process during the tension infiltration measurements. Under ponded flow, 73% of the flux was conducted through macropores (i.e., pores greater than 0.1 cm diameter). An estimated 96% of the water flux was transmitted through only 0.32% of the soil volume. The larger the total water flux, the larger the macropore contribution of total water flux. The Shapiro-Wilk normality test indicated that water flux through both the matrix pore space and macropores, was log-normally distributed in space. (Author's abstract)
W87-02917

FLURIDONE RETENTION AND RELEASE IN SOILS,
North Carolina State Univ. at Raleigh. Dept. of Crop Science.
For primary bibliographic entry see Field 5B.
W87-02918

CHARACTERIZATION AND CLASSIFICATION OF SEASIDE-SALT-MARSH SOILS ON VIRGINIA'S EASTERN SHORE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
For primary bibliographic entry see Field 2L.
W87-02919

STOCHASTIC APPROACH TO THE CROP YIELD-IRRIGATION RELATIONSHIPS IN HETEROGENEOUS SOILS: II. APPLICATION TO IRRIGATION MANAGEMENT,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Dept. of Soil Physics
For primary bibliographic entry see Field 3F.
W87-02922

GOODNESS OF FIT FOR EIGHT WATER INFILTRATION MODELS,
Louisiana State Univ., Baton Rouge. Dept. of Agronomy.
B. Davidoff, and H. M. Selim.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 3, p 759-764, May-June 1986. 4 fig, 7 tab, 26 ref.

Descriptors: *Statistical methods, *Infiltration, *Statistical models, *Soil water, Infiltration rate, Winter cover, Regression analysis, Soil stypes, Model studies, Wheat, Vetch, Fertilizers, Nitrogen, Permeability coefficient.

Eight infiltration models were investigated for their ability to describe water infiltration into soils. The models were: Philip's, Modified Philip's, Kostiakov's, Talsma and Parlange's, Horton's, and Lewis and Milen's. Field measurements of water infiltration were made using single ring infiltrometers on field plots established on a Norwood soil, with four long-term (27 yr) winter cover crop treatments followed by cotton each year. The four treatments were: (i) common vetch, (ii) wheat + 60 kg/ ha N; (iii) 60 kg/ha N, and (iv) check (no fertilizer or winter cover). Measured infiltration rates for the winter cover treatments were significantly higher than for the check plots. All models showed good agreement with measured infiltration with the exception of Lewis and Milne's. Model parameters obtained by best fit of measured data, were significantly different among the winter cover treatments. Horton, Kostiakov and Philip equations provided best predictions over all other models. Soil bulk density and saturated hydraulic conductivity for two soil depths were not affected by the winter cover treatments. (Author's abstract)
W87-02923

SOIL COMPACTION AND MOISTURE STRESS PRECONDITIONING IN KENTUCKY BLUEGRASS. I. SOIL AERATION, WATER USE, AND ROOT RESPONSES,
Iowa State Univ., Ames. Dept. of Horticulture.
M. L. Agnew, and R. N. Carrow.
Agronomy Journal AGJOAT, Vol. 77, No. 6, p 872-878, November-December 1985. 3 fig, 4 tab, 23 ref.

Descriptors: *Soil compaction, *Moisture stress, *Soil aeration, *Water use, *Roots, *Turf grasses, Irrigation, Soil porosity, Oxygen requirements, Soil density, Irrigation effects.

Root responses to soil compaction and moisture stress preconditioning were studied with respect to their effects on water use by Kentucky bluegrass. Conditions ranged from no compaction to short and long term compaction. Irrigation regimes were initiated concurrently with long term compaction and included well-watered and water stressed treatments. A 99-day dry-down cycle was started after preconditioning treatments were initiated and watering to saturation. Compaction treatments reduced the oxygen diffusion rate compared with uncompacted turf. Long term compaction increased root weights in the upper five centimeters and decreased them in the lower 10 to 20 centimeter profile. Short term compaction decreased root weights only at 15 to 20 centimters. Root porosity was increased by long term compaction, but the greatest increase was experienced with a combination of long term compaction and water stress. Plants with higher root porosities exhibited greater water uptake during low soil oxygen conditions. Soil compaction reduced total water use and moisture extraction in the deeper zones. Moisture stress preconditioning had no effect on root distribution, but caused greater total water use in the zero to five and 5-10 centimeter soil zones. (See also W87-02983) (Author's abstract)
W87-02982

SOIL COMPACTION AND MOISTURE STRESS PRECONDITIONING IN KENTUCKY BLUEGRASS. II. STOMATAL RESISTANCE, LEAF WATER POTENTIAL, AND CANOPY TEMPERATURE,
Iowa State Univ., Ames. Dept. of Horticulture.
M. L. Agnew, and R. N. Carrow.
Agronomy Journal AGJOAT, Vol. 77, No. 6, p 878-884, November-December 1985. 6 fig, 2, tab, 24 ref.

Descriptors: *Soil compaction, *Moisture stress, *Stomata resistance, *Plant water potential, Plant growth, Plant physiology, Plant tissues, Turf grasses, Irrigation, Temperature effects, Oxygen requirements, Irrigation effects.

The effects of soil conditioning and moisture stress preconditioning on stomatal diffusive resistance, leaf water potential and canopy minus air temperatures of Kentucky bluegrass were studied. Com-

paction treatments ranged from no compaction to short and long term compaction. Irrigation regimes were initiated concurrently with long term compaction and included well-watered and water stressed treatments. A 99-day dry-down period was started after initiating preconditioning and watering to saturation. Stomatal diffusive resistance, leaf water potential and canopy temperature were monitored on a daily basis. Stomatal diffusive resistance was initially low and then increased over a five-day period under low soil oxygen conditions. By the ninth day after irrigation, this declined, but then increased as soil water potential decreased. As soil water deficits increased, plants preconditioned to long term compaction or those which were water stressed exhibited lower leaf water potential and higher stomatal diffusive resistance and canopy temperature when compared with plants that were uncompacted or well-watered. Regardless of the cause of stomatal diffusive resistance, the result would be lower photosynthesis and greater high temperature stress. (See also W87-02982) (Author's abstract)
W87-02983

EFFECT OF HIGH SULFATE IRRIGATION WATERS ON SOIL SALINITY AND YIELDS,
Agricultural Research Inst., Nicosia (Cyprus). Soils and Water Use Section.
For primary bibliographic entry see Field 3C.
W87-02996

RESISTANCE OF PLANT ROOTS TO WATER LOSS,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
For primary bibliographic entry see Field 2I.
W87-03005

SOILS INFLUENCE IRRIGATION,
LESCO, Inc., Rocky River, OH.
B. J. Augustin.
Grounds Maintenance, Vol. 21, No. 6, p 44, 48, 70, June 1986.

Descriptors: *Soil types, *Irrigation efficiency,*Soil moisture retention, *Turf grasses, Soil water, Irrigation.

Soils have physical and chemical properties that regulate many aspects of plant development because soils have a great influence on how plants use soil water and nutrients. The soil also determines to a large extent how turfgrasses and ornamental plants grown in it are managed. Types of soil water and factors influencing soil moisture holding capacity are reviewed. Turfgrass irrigation strategies are discussed in relation to various types of soil. Alternative strategies are to apply water at slower rates and amounts by either running several short cycles or using lower volume irrigation nozzles, and by keeping the moisture level in the soil much higher and not cycling from field capacity to wilt. This is particularly useful in hard-to-wet soils like heavy clays. (Alexander-PTT)
W87-03020

VERTICAL-HORIZONTAL TRANSPORT AND FATE OF LOW WATER SOLUBILITY CHEMICALS IN UNSATURATED SOILS,
Oregon State Univ., Corvallis. Dept. of Mathematics.
F. T. Lindstrom, and W. T. Piver.
Journal of Hydrology JHYDA7, Vol. 86, No. 1/2, p 93-131, September 1986. 22 fig, 6 tab, 8 ref, append. NIEHS Grants ES 00040, ES 00210; NIEHS Consulting contract 8324080-2111.

Descriptors: *Path of pollutants, *Vertical flow, *Solute transport, *Horizontal flow, *Solubilty, *Soil saturation, *TDWHCX model, *ODWHCX model, Aquifers, Computers models, Boundary conditions, Hydraulic properties, Dispersivity, Shallow water.

The vertical transport and fate of water, heat, and toxic chemicals in a simple shallow aquifer model are used in a combined model. A two-space dimensional transport and fate model (TDWHCX) is online on a DEC VAX 11/781 system. Boundary conditions used the method of approximate solution, and several realistic long time simulations are presented and discussed. TDWHCX is found to be a useful tool for analyzing the simultaneous transport of heat, moisture and chemicals with low water solubility in unsaturated shallow aquifers with spatial variability in soil and hydraulic properties. For coupled models that include chemical transport, the relative magnitudes of the dispersivity and nodal spacing must be chosen carefully to minimize oscillatory behavior in the solution vector for concentration at positions of rapid change. With these simple considerations, TDWACX is a powerful tool for examining the transport and fate of a wide variety of chemicals in a wide variety of soils. (Alexander-PTT)
W87-03074

PROCEDURE TO IDENTIFY DIFFERENT GROUPS OF HYDRAULIC-CONDUCTIVITY AND MOISTURE-RETENTION CURVES FOR SOIL HORIZONS,
Stichting voor Bodemkartering, Wageningen (Netherlands).
J. H. M. Wosten, M. H. Bannink, J. J. De Gruijter, and J. Bouma.
Journal of Hydrology JHYDA7, Vol. 86, No. 1/2, p 133-145, September 1986. 8 fig, 15 ref.

Descriptors: *Permeability coefficient, *Soil water, *Simulation analysis, *Moisture retention, *Soil horizons, Soil columns, Soil properties, Soil surfaces, Water table, Standard error, Statistical analysis, Fluctuations, Flow profiles, Aeration zone, Unsaturated flow.

Saturated and unsaturated hydraulic-conductivity and moisture-retention data are important soil-physical properties for models simulating water movement in the unsaturated zone. A major problem in applying simulation models is a lack of data. Saturated and unsaturated hydraulic-conductivity and moisture retention data were measured in 25 C horizons with a sand texture and in 23 C horizons with a clay loam and silty clay loam texture. Measurements were made on large, undisturbed soil columns. The identification of two types of C horizons was based on calculated functional properties rather than on physical characteristics themselves. Three functional properties were distinguished: (1) travel times from soil surface to water table, (2) water table depth allowing a defined upward flux density, and (3) downward flux densities at a defined air content. The two types of horizons considered were identified as two distinct groups by analyzing the standard errors of prediction of the three functional properties. Graphs were presented that allow an estimate of the desired accuracy (expressed in terms of a prediction interval) as a function of sample size and measurement costs. The procedure illustrated for two textural classes can be applied to all textures in the future. (Alexander-PTT)
W87-03075

EFFECT OF WOVEN PLASTIC MULCH, HERBICIDES, GRASS SOD, AND NITROGEN ON 'FOCH' GRAPES UNDER IRRIGATION,
Department of Agriculture, Summerland (British Columbia). Research Station.
For primary bibliographic entry see Field 3F.
W87-03106

SEASONAL RESPONSE OF 'ANJOU' PEAR TREES TO DIFFERENT IRRIGATION REGIMES. I. SOIL MOISTURE, WATER RELATIONS, TREE AND FRUIT GROWTH,
Washington State Univ., Wenatchee. Tree Fruit Research Center.
For primary bibliographic entry see Field 3F.
W87-03110

GEOCHEMICAL AND ENVIRONMENTAL PROCESSES AFFECTING RADIONUCLIDE MIGRATION FROM A FORMERLY USED SEEPAGE TRENCH,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5E.
W87-03135

COMPACTION, HYDROLOGICAL PROCESSES AND SOIL EROSION ON LOAMY SANDS IN EAST SHROPSHIRE, ENGLAND,
Polytechnic Wolverhampton (England).
For primary bibliographic entry see Field 2J.
W87-03160

MECHANIZED TILLAGE SYSTEMS EFFECTS ON PROPERTIES OF A TROPICAL ALFISOL IN WATERSHEDS CROPPED TO MAIZE,
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
R. Lal.
Soil and Tillage Research SOTRD5, Vol. 6, No. 2, p 149-161, November 1985. 2 fig, 7 tab, 10 ref.

Descriptors: *Tropical alfisol, *Corn, *Nigeria, *Soil properties, *No-tillage management, *Herbicides, *Plowing, *Harrowing, Hydrogen ion concentration, Soil organic matter, Ibadan, Mechanical cultivation, Soil compaction, Infiltration rate, Agriculture.

The effects of 6 yr of continuous cultivation in 12 consecutive crops of maize (Zea mays) on changes in the physical and chemical properties of and Alfisol in Ibadan (Nigeria) were investigated for two mechanical tillage systems imposed on twin watersheds of about 5 ha each. The tillage methods were no-tillage, with herbicides for weed control, and conventional plowing and harrowing. The soil organic matter content of the 0- to 10-cm layer of the no-tillage watershed increased by 7%, whereas that of the plowed watershed decreased by 72%. Soil pH declined by 0.3 and 1.7 units in the no-tillage and plowed watersheds, respectively. As a consequence of pH changes, exchangeable cations declined with continuous cultivation, regardless of the tillage method, although the rate of decline was more drastic in the plowed than in the no-tillage watershed. Continuous mechanized cultivation substantially decreased infiltration rate. Soil compaction was more severe at the tractor's turning points than along the plot's border. The results are discussed in terms of tillage needs and implications for mechanized farming in the tropics. (Author's abstract)
W87-03162

COMPACTION AND TILLAGE DEPTH COMBINATIONS FOR WATER MANAGEMENT AND RICE PRODUCTION IN LOW-RETENTIVE PERMEABLE SOILS,
Indian Inst. of Tech., Kharagpur. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W87-03163

EFFECTS OF TILLAGE METHODS AND WATER REGIMES ON SOIL PROPERTIES AND YIELD OF LOWLAND RICE FROM A SANDY LOAM SOIL IN SOUTHWEST NIGERIA,
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
For primary bibliographic entry see Field 2I.
W87-03164

EFFECT OF DEEP TILLAGE AND CONTROLLED TRAFFIC ON ROOT GROWTH, WATER-USE EFFICIENCY AND YIELD OF IRRIGATED MAIZE AND WHEAT,
Orange Free State Univ., Bloemfontein (South Africa). Dept. of Soil Science.
For primary bibliographic entry see Field 3F.
W87-03165

EFFECT OF TILLAGE AND MULCHING ON SOIL ENVIRONMENT AND COWPEA SEEDLING GROWTH UNDER ARID CONDITIONS,
Central Arid Zone Research Inst., Jodhpur (India). Div. of Soil-Water-Plant Relationship Studies.
For primary bibliographic entry see Field 3F.

W87-03166

EVAPORATION AND REDISTRIBUTION OF SALTS IN A SILT LOAM SOIL AS AFFECTED BY TILLAGE INDUCED SOIL MULCH,
Central Soil Salinity Research Inst., Karnal (India).
For primary bibliographic entry see Field 3F.
W87-03168

EFFECT OF SUBSOILING AND IRRIGATION ON POTATO PRODUCTION,
New Zealand Soil Bureau, Lower Hutt.
For primary bibliographic entry see Field 3F.
W87-03169

EFFECTS OF IN-ROW AND INTERROW SUBSOILING AND TIME OF NITROGEN APPLICATION ON GROWTH, STOMATAL CONDUCTANCE AND YIELD OF STRIP-TILLED CORN,
Alabama Agricultural Experiment Station, Auburn.
For primary bibliographic entry see Field 3F.
W87-03170

PHYSICAL ENVIRONMENT NEAR THE SURFACE OF PLOWED AND NO-TILLED SOILS,
Science and Education Administration, Lincoln, NE
L. N. Mielke, J. W. Doran, and K. A. Richards.
Soil and Tillage Research SOTRD5, Vol. 7, No. 4, p 355-366, August 1986. 1 fig, 3 tab, 29 ref.

Descriptors: *Soil water, *Bulk density, *Permeability coefficient, *Air permeability, *Organic carbon, *Moldboard plowing, *No-tillage management, United States, Corn, Wheat, Fallowing, Soil physical properties, Pore spaces, Soil aeration, Tillage depth.

Water content, bulk density, air permeability, hydraulic conductivity, and organic C were compared for moldboard-plowed and non-tilled conditions at five locations from the East-Central United States to the Great Plains. Soils were Blount, Maury, Nicollet, Webster, and Crete-Butler cropped to continuous corn, and Alliance and Duroc cropped to wheat/fallow. Major differences in soil physical characteristics between tillage practices were largely confined to the top 75 mm of soil. The volumetric water and organic C contents of the 0-150 mm layer at time of sampling ranged from 8 to 66% and 12 to 75% higher, respectively, in no-tilled than in plowed soils. Bulk density was greater and total porosity in the surface layer was as much as 10% less for no-tilled than for plowed treatments. Because of generally higher water contents and/or lower porosity, the water-filled pore spaces in the 0-150 mm layer of no-tilled soils was 6-28% higher than that of plowed soils. Air permeability in the surface layer of no-tilled soil was less than for plowed, but there were no differences due to tillage in the 75-150 mm depth. (Rochester-PTT)
W87-03171

TRANSPORT OF CONSERVATIVE TRACERS IN THE FIELD UNDER INTERMITTENT FLOOD IRRIGATION,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
R. S. Bowman, and R. C. Rice.
Water Resources Research WRERAQ, Vol. 22, No. 11, p 1531-1536, October 1986. 4 fig, 2 tab, 19 ref.

Descriptors: *Tracers, *Groundwater movement, *Flood irrigation, Flow velocity, Soil water, Irrigation practices, Model studies, Hydrologic budget.

The velocity of downward percolating water measured using tracer concentration profiles was compared to the macroscopic velocity calculated from a water balance. Experiments were performed in a 37-cu m field plot under intermittent flood irrigation. Five different soil water tracers were used to follow the movement of six applied water pulses over a period of 10 months under two irrigation regimes. Mean water velocities measured with the tracers averaged 60-70% greater than the calculated macroscopic velocity. The results indicated that a significant portion of the applied water moved downward through preferential flow paths, even under unsaturated conditions. The measured velocities were not sensitive to irrigation frequency as long as total water applied remained constant. The data indicate that simple water balance models may overestimate arrival times of surface-applied water and chemicals to groundwater. (Author's abstract)
W87-03191

2H. Lakes

DETERMINATION OF POLLUTION AND EUTROPHIC CONDITIONS OF SAPANCA LAKE (TURKEY),
Marmara Scientific and Industrial Research Inst., Gebze (Turkey). Dept. of Nutrition and Food Technology.
For primary bibliographic entry see Field 5B.
W87-02587

RATIONAL ALLOCATION OF MONITORING STATIONS IN A LAKE BY MEANS OF THE SPLINE TECHNIQUE,
Kyoto Univ. (Japan). Dept. of Environmental and Sanitary Engineering.
For primary bibliographic entry see Field 7A.
W87-02598

INTERACTIVE ALGORITHM FOR THE PARAMETER ESTIMATION OF COMPLEX SYSTEMS AND ITS APPLICATION TO AN ECOLOGICAL MODELLING OF AN ACTUAL JAPANESE LAKE,
Science Univ. of Tokyo (Japan). Dept. of Management Science.
N. Nishida, S. Hiratsuka, T. Tanaka, and T. Okino.
Ecological Modelling, Vol. 32, No. 1-3, p 85-93, June 1986. 2 fig, 1 tab, 6 ref.

Descriptors: *Lake Suwa, *Phytoplankton, *Biomass, *Multiple-criteria problems, *Model studies, *Simulation, Computer analysis, Video display terminals, Lakes, Simplex method, Nonlinear programming, Mathematical models.

An interactive algorithm for the parameter estimation of complex ecological models was used in a phytoplankton biomass model of Lake Suwa (Japan), a 13.3-sq km lake of 4.1 m mean depth. The algorithm is based on the interactive algorithm of multiple-criteria problems developed by Kobayashi and Ichikawa. The search of unknown parameters was based on the simplex method, which is a direct search method for the solution of unconstrained nonlinear programming problems. The validity of the simulated results is checked by the modeler by interacting with the computer using a visual display terminal. The check of validity is made by pairwise comparisons. On the basis of the pairwise comparisons, parameter values are updated by the simplex method. Because the comparison is made by the modeler, the method proposed is applicable to the following cases: (1) insufficient data are available for use of the least-squares method, (2) a number of unusual or biased data are included in the measurements, (3) there are constraints on the values that the parameters may have, (4) there may be more unknown parameters than constraints, and (5) the predictions must agree with observed behavior in terms of timing of peaks. (Rochester-PTT)
W87-02600

VALIDATION OF A PROGNOSIS BASED UPON A EUTROPHICATION MODEL,
Royal Danish School of Pharmacy, Copenhagen.
For primary bibliographic entry see Field 5C.
W87-02602

ENVIRONMENTAL GRADIENTS IN NORTHWEST FRESHWATER WETLANDS,
Corvallis Environmental Research Lab., OR.
W. D. Sanville, H. P. Eilers, T. R. Boss, and T. G. Pfleeger.
Environmental Management EMNGDC, Vol. 10, No. 1, p 125-134, January 1986. 11 fig, 28 ref.

Descriptors: *Wetlands, *Limnology, *Environmental gradients, Bayous, Bogs, Marshes, Swamps, Oregon, Statistical analysis, Moisture, Vegetation.

Wetland environmental characteristics are examined for spatial and temporal relationships. Two very different Oregon freshwater wetlands provided a range of wetland types. Results are evaluated to determine the possible use of environmental characteristics in defining wetlands and their boundaries. Representative physical, hydrological, and edaphic properties were periodically measured in microplots along upland/wetland transects. A multi-variate approach is stressed in the data analysis; correlation, cluster analysis, and principal components analyses were used. The results indicate that environmental characteristics change quantifiably, both spatially and temporally. The controlling mechanism is moisture; spatially in terms of the upland/wetland transect and temporally with respect to seasonal response. These changes do not correlate well with vegetation. Several hypotheses are offered as an explanation. (Author's abstract)
W87-02615

EFFICIENT METHOD OF APPLYING ALUMINUM SALTS FOR SEDIMENT PHOSPHORUS INACTIVATION IN LAKES,
New Hampshire Water Supply and Pollution Control Commission, Concord.
For primary bibliographic entry see Field 5G.
W87-02635

CLASSIFICATION OF DRAINAGE BASINS ACCORDING TO THEIR PHYSICAL CHARACTERISTICS; AN APPLICATION FOR FLOOD FREQUENCY ANALYSIS IN SCOTLAND,
Saint Andrews Univ. (Scotland). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W87-02683

CLASSIFICATION OF MACROPHYTES IN BODIES OF WATER AND OF AQUATIC VEGETATION,
All-Union Scientific Research Inst. of Game Management and Fur Breeding, Volga (USSR).
V. G. Papchenkov.
Soviet Journal of Ecology SJECAH, Vol. 16, No. 6, p 316-320, November-December 1986. Translated from Ekologiya, No. 6, p 8-13, November-December 1985. 35 ref.

Descriptors: *Limnology, *Classification, *Macrophytes, *Aquatic environment, *Aquatic plants, *Ecosystems, Environment, Aquatic life, Aquatic habitats, Ecology, Plant morphology, Floating plants, Submerged plants, Amphibious plants, Shores, Mosses, Bogs, Wetlands, Rooted aquatic plants, Sea grasses, Marsh plants.

The scope of the concepts 'macrophytes in bodies of water' and 'aquatic plants' is discussed. Classifications of macrophytes and macrophytic vegetation in waters, constructed with consideration of plant morphology, biology, and ecology, are presented. Macrophytes encountered in bodies of water and streams of the Central Volga Region are classified as follows: (1) hydrophytes, or true aquatic plants; (2) geophytes, or aerial-aquatic plants; and (3) near-water plants. Hydrophytes include hydrophytes freely floating in the water; submerged, rooted hydrophytes; hydrophytes freely floating on the surface; and rooted hydrophytes with floating leaves. Geophytes include tall-grass helophytes; short-grass helophytes; and ground-hugging helophytes. Near-water plants include hygrohelophytes; herbaceous hygrophytes; woody hygrophytes; and hygromesophytes. The concepts, 'aquatic plants' and 'plants of bodies of water' should be separated, assigning to the latter the entire set of species invariably encountered in

an aquatic environment, and to the former only hydrophytes and helophytes. (Doria-PTT)
W87-02772

SANITARY STUDY OF SURFACE WATER AND OF THE BEACH OF A WATER SPORTS AND LEISURE COMPLEX,
Service des Maladies Parasitaires et Exotiques, Angers (France).
For primary bibliographic entry see Field 5B.
W87-02777

VERTICAL DIFFUSION IN MEROMICTIC POWELL LAKE, BRITISH COLUMBIA,
Memorial Univ. of Newfoundland, St. John's. Dept. of Physics.
B. Sanderson, K. Perry, and T. Pedersen.
Journal of Geophysical Research (c) JGRCEY, Vol. 91, No. C6, p 7647-7655, June 1986. 11 fig, 20 ref.

Descriptors: *Vertical diffusion, *Model studies, *Powell Lake, British Columbia, *Fjords, *Meromictic lakes, Lakes, Chlorine, Water depth, Ions, Diffusion coefficient, Temperature, Heat flow, Flow, Physicochemical properties, Chemical properties, Hydrology, Geophysics.

Simple diffusion models are developed to describe vertical diffusion in Powell Lake, a meromictic former fjord containing trapped seawater. Measurements of the vertical distribution of chlorinity are used to determine the dependence of vertical diffusivity on depth. The vertical diffusivity near the bottom of the lake is about four times that of the molecular diffusivity of salt. On this basis, ions with different molecular diffusion coefficients will be lost from the bottom of the lake at different rates, partially explaining the differences observed in the ratios of concentrations of ions in saline bottom water from ratios characteristic of seawater. The observed increase in temperature with depth is shown to result from the geothermal heat flux through the bottom of the lake. (Author's abstract)
W87-02780

EFFECTS OF DISTURBANCE ON EPIPHYTIC COMMUNITY ARCHITECTURE,
Wisconsin Univ.-La Crosse. River Studies Center.
M. R. Luttenton, and R. G. Rada.
Journal of Phycology JPYLAJ, Vol. 22, No. 3, p 320-326, September 1986. 11 fig, 3 tab, 29 ref.

Descriptors: *Disturbance, *Epiphytes, *Ecosystems, *Distribution patterns, *Ecological effects, *Ecology, Mississippi River, Electron microscopy, Microscopy, Aquatic flora, Distribution, Ecological distribution, Waves, Cladophora, Turbulent flow.

Microdistributional patterns of attached algal communities on Cladophora and glass slides were compared under varying disturbance regimes in the Upper Mississippi River, using light and scanning electron microscopy. Localized physical disturbance, induced by boat traffic and wind-generated wave action in the main channel, inhibited development of complex attached algal communities and maintained an adnate flora with two-dimensional architecture. In contrast, communities protected from disturbance developed a more complex, three-dimensional architecture. Communities on Cladophora and on glass substrates exposed to similar levels of disturbance exhibited a high degree of architectural similarity. Communities exposed to severe disturbance resembled ones in early stages of colonization and development, whereas less disturbed communities were similar to ones in advanced stages of development. These results demonstrated that turbulence strongly influences the community structure of periphyton on both micro- and macroscale levels. (Author's abstract)
W87-02806

EFFECTS OF CURRENT VELOCITY AND LIGHT ENERGY ON THE STRUCTURE OF PERIPHYTON ASSEMBLAGES IN LABORATORY STREAMS,
Oregon State Univ., Corvallis. Dept. of Botany and Plant Physiology.
A. D. Steinman, and C. D. McIntire.
Journal of Phycology JPYLAJ, Vol. 22, No. 3, p 352-361, September 1986. 22 fig, 4 tab, 37 ref. NSF Grant BSR-8318386.

Descriptors: *Ecosystems, *Water currents, *Light energy, *Lotic environment, *Periphyton, *Taxonomy, Environment, Species composition, Ecology, Synedra, Achnanthes, Stigeoclonium, Algae, Diatoms, Succession.

Effects of current velocity and light energy on the taxonomic and physiognomic characteristics of periphyton assemblages were investigated in laboratory streams. Initial colonization rates were related to current velocity, while the effects of light energy accounted for subsequent differences in species composition. Although the laboratory systems had many species in common during the early stages of colonization, the experimental treatments generated differences in rates of community development. Synedra spp. were the early colonizers of the substrate, followed by an understory of Achnanthes spp. After 16 days, Stigeoclonium tenue developed in the streams exposed to the higher photon flux density, but was rare in the shaded streams. The applicability of traditional successional theory to developmental patterns in lotic periphyton assemblages is discussed. (Author's abstract)
W87-02808

LAKE ACIDIFICATION AND THE LAND-USE HYPOTHESIS: A MID-POST-GLACIAL ANALOGUE,
University Coll., London (England). Palaeoecology Research Unit.
For primary bibliographic entry see Field 2K.
W87-02810

MACROPHYTE GROWTH IN SHALLOW STREAMS: FIELD INVESTIGATIONS,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5C.
W87-02887

MACROPHYTE GROWTH IN SHALLOW STREAMS: BIOMASS MODEL,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 5C.
W87-02888

DECOMPOSITION STUDIES IN TWO CENTRAL ONTARIO LAKES HAVING SURFICIAL PHS OF 4.6 AND 6.6,
Toronto Univ. (Ontario). Dept. of Microbiology.
J. F. M. Hoeniger.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 3, p 489-497, September 1986. 7 fig, 2 tab, 54 ref.

Descriptors: *Fate of pollutants, *Path of pollutants, *Acidic water, *Detritus, *Decomposition, *Hydrogen ion concentration, *Microbial degradation, *Lakes, Ecosystems, Particulate matter, Recycling, Nutrients, Cellulose, Sediments, Water column, Shield lakes, Anthropogenic pollution sources, Hypolymnion, Water chemistry, Aquatic fungi, Lake sediments, Bacteria, Seasonal variation.

The rates of cellulosic breakdown, composition of detrital microflora, and density of bacterial populations were determined in the epilimnetic sediments and water columns of 2 poorly buffered, oligotrophic, Canadian Shield lakes having mean surficial pHs of 4.6 and 6.6. The decomposition rate was significantly lower in oxic sediment of the acidfied lake than of the circumneutral lake, but water column rates were almost identical in the 2 lakes. These results are explained in terms of the groups of the cellulolytic microorganisms which were observed by phase-contrast microscopy as being active at the different sites: fungi in 4.6 lake water and Cytophaga-like bacteria in the water and sediment of 6.6 lake. Cytophaga-like bacteria were also the main decomposers in 4.6 lake sediment, but their activity was restricted at porewater pHs of <5.0. Acridine orange direct counts of bacteria in the top cm of sediment ranged from 3.7 times 10 to the 8th power to 1.0 times 10 to the 9th power/g, and counts in planktonic water samples ranges from 490000 to 1200000/ml. Bacterial densities at most sites decreased significantly ($P < 0.001$) from August to late October, but did not show a consistent pattern of differences related to pH. (Author's abstract)
W87-02897

UNDERWATER LIGHT CLIMATE AND THE GROWTH AND PIGMENTATION OF PLANKTONIC BLUE-GREEN ALGAE (CYANOBACTERIA) I. THE INFLUENCE OF LIGHT QUANTITY,
Westfield Coll., London (England). Dept. of Botany and Biochemistry.
M. Wyman, and P. Fay.
Proceedings of the Royal Society of London, Vol. B.227, No. 1248, p367-380, April 1986. 6 fig, 1 tab, 52 ref.

Descriptors: *Light intensity, *Growth, *Pigmentation, *Plankton, *Cyanophyta, Radiation, Chlorophyll, Light, Phycobiliproteins.

The influence on the growth and pigmentation of eight strains of blue-green algae have been investigated, with variations in light under defined laboratory conditions. In light-limited cultures, the relative concentrations of chlorophyll and phycobiliproteins per cell decline directly with increasing radiation. Once the maximum growth rate is reached, exposure to higher photon flux densities resulted in a further decline in light-harvesting capacity per cell, and also in a reduction of the light adsorption band width because of a preferential decrease in phycobiliprotein synthesis. At irradiances lower than those required for maximum growth rates, the net rates of chlorophyll and phycobiliprotein synthesis decline as growth becomes progressively light-limited. This appear to be imposed by genotypic constraints on maximum cell density, and on the size of photosynthetic units rather than by either light or nutrient limitations of chlorophyll and phycobiliprotein synthesis. (See also W87-02909) (Author's abstract)
W87-02908

UNDERWATER LIGHT CLIMATE AND THE GROWTH AND PIGMENTATION OF PLANKTONIC BLUE-GREEN ALGAE (CYANOBACTERIA) II. THE INFLUENCE OF LIGHT QUALITY,
Westfield Coll., London (England). Dept. of Botany and Biochemistry.
M. Wyman, and P. Fay.
Proceedings of the Royal Society of London, Vol. B 227, No. 1248, p 381-193, April 1986. 7 fig, 2 tab, 27 ref.

Descriptors: *Growth rates, *Pigmentation, *Plankton, *Cyanobacteria, *Cyanophyta, Radiation, *Light intensity, Phycobiliprotein.

The influence of light quality on the growth, and chlorophyll and phycobiliprotein composition of eight strains of planktonic blue-green algae has been investigated. Growth rate in chromatic light is a general function of the light absorption capacity of the cell. In Oscillatoria redekei and Gloeotrichia echinulata CC1 growth rates exceed the maximum growth rate possible in white light, of a higher photon flux density. In green light the growth rate of six phycocyanin-rich strains is approximately 60-75% of that in white light but growth rate is enhanced in O. agardhii 7821 and G. echinulata CC1 . With the exception of these two phycoerythrin-producing strains, incubation in blue light results in a pronounced reduction in growth rate which is associated with a specific decline in cell chlorophyll concentrations. Cell chlorophyll and phycobiliprotein content is similar in both white and green light. Enhancement of the growth rate in red light is associated with a general decline in cell pigment concentrations. An increase

the cell chlorophyll: phycobiliprotein ratio also occurs in a number of strains in red light, where the growth rate is at or near its maximum rate, and in Gloeotrichia echinulata CCI is the result of a specific reduction in the rate of phycoerythrin synthesis. The modulation of phycoerythrin synthesis in this strain is influenced considerably by the photon flux density of red light. (See also W87-02909) (Author's abstract)
W87-02909

EFFECT OF CATCHMENT SIZE ON PHOSPHORUS EXPORT,
McGill Univ., Montreal (Quebec). Dept. of Biology.
For primary bibliographic entry see Field 5B.
W87-02941

SYNTHESIS AND ANALYSIS OF A COMPREHENSIVE LAKE MODEL - WITH THE EVALUATION OF DIVERSITY OF ECOSYSTEMS,
National Inst. for Environmental Studies, Tsukuba (Japan). Water and Soil Environment Div.
T. Goda, and Y. Matsuoka.
Ecological Modelling, ECMODT Vol. 31, No. 1-4, p 11-32, May 1986. 12 fig, 5 tab, 40 ref, append.

Descriptors: *Lake Kasumigaura, *Ecosystems, *Limnology, *Mathematical models, *Lakes, *Phytoplankton, *Zooplankton, *Fish, *Opossum shrimp, *Nutrients, Japan, Lake fisheries, Species diversity.

The characteristics of Lake Kasumigaura (Nishiura, Japan) are summarized, the development and verfication of ecological models of this system are described, and species diversity within the system is analyzed. The comprehensive lake behavior model of Lake Kasumigaura takes into account phytoplankton, zooplankton, fishes and opossum shrimp, and external nutrient compartments. Nutrient flows within the lake were calculated with the model, and a prediction of water quality estimated for 1990 is provided, with a discussion of policies for water quality improvement. The diversity of marketable fish for the period 1956-1982 was determined and is considered here in relation to the total fish catch (excluding shellfish). (Rochester-PTT)
W87-02965

MODELLING OF STRATIFIED FLOW AND EUTROPHICATION IN RESERVOIRS,
Central Research Inst. of Electric Power Industry, Tokyo (Japan). Civil Engineering Lab.
For primary bibliographic entry see Field 5C.
W87-02968

THREE-DIMENSIONAL WATER-QUALITY-TRANSPORT MODEL COMPARED WITH FIELD OBSERVATIONS,
Valtion Teknillinen Tutkimuskeskus, Espoo (Finland). Reaktorilaboratorio.
M. Virtanen, J. Koponen, K. Dahlbo, and J. Sarkkula.
Ecological Modelling, ECMODT Vol. 31, No. 1-4, p 185-199, May 1986. 5 fig, 4 tab, 10 ref.

Descriptors: *Ecological model, *Field tests, *Limnology, *Hydrodynamic models, *Dissolved oxygen, *Lake Nasiselka, *Phosphorus, *Thermal stratification, *Phytoplankton, *Biomass, *Transport, Flow regulation, Pollution load, Finland, transport velocity, Distribution.

An ecological model coupled with a hydrodynamic one was applied to lake Nasiselka, the southernmost sub-basin of Lake Nasijarvi, central Finland. Its surface area is 93 sq km, mean depth 15 m, maximum depth 61 m, and through-flow 64 cu m/sec. The transport velocities to the ecological model were computed with a three-dimensional hydrodynamic sub-model, and the results were compared with the flow velocities measured in 1981. In the ecological model the transport velocities changed according to the weather conditions, through-flow, and temperature stratification. The ecological model computes dissolved oxygen, total P, phytoplankton biomass, biological oxygen demand, and sodium lignosulfonate taking into account their decay, settling, mutual reactions, loading and transport with water flow. The model validity was tested with extensive field data for 1982 and less extensive data for summer 1983. The results showed reasonable agreement with measured values. The model was used to test the effects of industrial loading and regulation of through-flow on the water quality. Industrial loading affects the oxygen and algal distributions in the lake, whereas the executed regulation has not changed appreciably the natural conditions in the lake. (Author's abstract)
W87-02970

EUTROPHICATION MODEL OF LAKE KASUMIGAURA,
Kyoto Univ. (Japan). Faculty of Engineering.
Y. Matsuoka, T. Goda, and M. Naito.
Ecological Modelling, ECMODT Vol. 31, No. 1-4, p 201-219, May 1986. 7 fig, 8 tab, 24 ref.

Descriptors: *Lake Kasumigaura, *Nutrient dynamics, *Eutrophication, *Mathematical models, *Lake sediments, *Fish, Opossum shrimp, Detritus, Phytoplankton, Grazing, Japan, Fish food, Field tests, Mass balance.

A mathematical model of nutrient dynamics in Lake Kasumigaura (Japan) is described; it consists of 4 segments with 14 compartments in each segment. The model includes two phytoplankton and zooplankton groups and cycles of N and P. The model performance agrees with field measurements and is capable of simulating the ecological properties of Lake Kasumigaura. The influence of internal nutrient load, especially that of the 'biological pump' was shown to be significant. The simulation showed that fishes and opossum shrimp influence significantly the lake's water quality; a model was developed of 'fresh sediment', which is edible by fishes and opossum shrimp. This model describes the mass balance among the settling of detritus and phytoplankton, the first-order decay, and animal grazing. (Rochester-PTT)
W87-02971

BOX MODEL FOR PREDICTION OF WATER QUALITY IN EUTROPHIC LAKES,
National Inst. for Environmental Studies, Tsukuba (Japan). Water and Soil Environment Div.
K. Muraoka, and T. Fukushima.
Ecological Modelling, ECMODT Vol. 31, No. 1-4, p 221-236, May 1986. 5 fig, 5 tab, 15 ref.

Descriptors: *Eutrophic lakes, *Box models, *Segmented models, *Limnology, *Long-term prediction, *Water quality, Prediction, Lakes, Peclet number, Japan, Lake Kasumigaura, Mathematical models, Advection, Dispersion.

A box model to be used for long-term prediction of water quality in shallow eutrophic lake. The required box number can be determined from the condition of coincidence of zeroth moments between solution curves of both box and advection-dispersion models. Factors to be considered are two dimensionless values: P sub e (the Peclet number) and P sub k, which is the ratio of reaction rate to advection. For non-conservative material, discussion of the higher-ordered moments is difficult. If the material is conservative, taking P sub k = 0, the condition of coincidences of the second moment can be discussed in correcting the value of the dispersion coefficient. This modification is necessary for large P sub e, but in the case of P sub e < or = 1, no correction is needed; the authors confirmed that P sub e in many shallow lakes is not this large. For box segmentation, the partition sites should be selected as each box possibly has retention times evaluated by both advective flow and exchange flow. The box model proposed here was applied to Lake Kasumigaura (Japan), where plenty of field data were available, and after confirmation of its appropriateness for water-quality prediction, it was extended to 12 other lakes in Japan with satisfactory results. (Rochester-PTT)
W87-02972

NUTRIENT AND TRACE METAL FLUXES IN THE MAGELA CREEK SYSTEM, NORTHERN AUSTRALIA,
Chisholm Inst. of Tech., Melbourne (Australia). Water Studies Centre.
For primary bibliographic entry see Field 2E.
W87-02974

STUDY OF DISSOLVED OXYGEN BUDGETS IN NATURAL AND ARTIFICIAL LAKES,
Tohoku Univ., Sendai (Japan). Dept. of Civil Engineering.
M. Takasaki, A. Sato, M. Okada, and R. Sudo.
Ecological Modelling, ECMODT Vol. 31, No. 1-4, p 283-292, May 1986. 7 fig, 10 ref.

Descriptors: *Limnology, *Dissolved oxygen budgets, *Artificial lakes, *Lake Yunoko, Lake Kamafusa, *Hypoliminion, *Lake sediments, Lakes, Japan, Sediment oxygen demand, Seasonal variation, Field tests, Mathematical models.

A field survey was conducted to evaluate the major factors that control dissolved oxygen (DO) concentration two Japanese lakes: Lake Yunoko (0.33 sq km) and Lake Kamafusa (2.66 sq km). Seasonally measured DO profiles resulted from phenomena such as oxygen production by photosynthesis, oxygen consumption by respiration, and/or sediment oxygen demand. A mathematical model was developed for calculating DO concentration in lakes. Major factors controlling hypolimnetic oxygen demand were calculated. It was demonstrated that the largest depletion of DO at the bottom layer was caused mainly by the sediment oxygen demand at Lake Yunoko in early summer. After DO depletion in the hypolimnion, water column oxygen demand became the dominant factor controlling vertical profiles of DO. (Author's abstract)
W87-02976

COST ANALYSIS OF THE ADVERSE EFFECTS OF ALGAL GROWTH IN WATER BODIES ON DRINKING WATER SUPPLY,
Institute of Public Health, Tokyo (Japan). Dept. of Sanitary Engineering.
For primary bibliographic entry see Field 5F.
W87-02977

REVIEW OF THE ROLE OF BED DEPOSITS IN THE PHOSPHATE EUTROPHICATION OF LAKES AND RIVERS,
Mid-Kent Coll. of Higher and Further Education, Chatham (England).
For primary bibliographic entry see Field 5B.
W87-03022

ASSOCIATION BETWEEN SOME PLANKTONIC SPECIES AND PHYSICOCHEMICAL CHARACTERISTICS OF THE WATER OF LOKTAK LAKE, MANIPUR, INDIA,
Jawaharlal Nehru Univ., New Delhi (India). School of Environmental Sciences.
B. Bhatia, H. L. Sarkar, D. K. Banerjee, and I. Haq.
International Journal of Environmental Studies IJEVAW, Vol. 26, No. 1/2, p 111-123, 1985. 13 fig, 2 tab, 19 ref.

Descriptors: *Phytoplankton, *Limnology, *Loktak Lake, *Takmu fish farm, *Zooplankton, *Seasonal variations, Diatoms, Chlorophyta, Protozoa, Hydrogen ion concentration, Dissolved oxygen, Carbon dioxide, Bicarbonates, Calcium, Cladocera, India.

Observations were made during 24-hr periods at 4-hr intervals on the phytoplankton and zooplankton in surface and bottom water samples from Loktak Lake (India), for the months of December 1977, April 1978, July 1978, and December 1978. The part of the lake sampled was the Takmu Fish Farm, which is well protected and subject to minimal perturbations. Attempts were made to correlate the abundance of phytoplankton and zooplankton with water temperature, pH, dissolved oxygen (DO), free CO2, bicarbonate, and Ca(2+). Highly

significant correlations, postive and negative, were observed between the diurnal and seasonal variations of physicochemical characteristics with those of total phytoplankton and zooplankton of certain species of diatoms, Chlorophyceae, Protozoa, and Cladocera. (Rochester-PTT)
W87-03025

EFFECTS OF VARIATION IN STREAMSIDE HABITATS ON THE COMPOSITION OF MOUNTAIN SALAMANDER COMMUNITIES,
North Carolina Univ. at Chapel Hill. Dept. of Biology.
M. T. Southerland.
Copeia, No. 3, p 731-741, August 1986. 4 fig, 2 tab, 33 ref.

Descriptors: *Salamanders, *Rivers, *Mountains, *Streambank cover, *Predation, *Ecology, North Carolina, Lost Cove Creek, North Harper Creek, Wilson Creek, Populations, Habitats.

Different assemblages of salamanders were found in different mountain streams within the same watershed (eight first- or second-order streams flowing into Lost Cove Creek and North Harper Creek, in the Wilson Creek watershed of Avery County, North Carolina). The species composition at each stream varied according to whether one or two semi-aquatic species were present. Where more than 50% of the streambank possessed cover, two semi-aquatic species occurred. The results of three studies indicate that the habitat affected interactions within this salamander community. The semi-aquatic Desognathus monticolus was found farther from water in streams with the larger semi-aquatic D. quadramaculatus than in streams without it. At a densely populated site, streambank burrows were monopolized by large desmognathines. The addition of rock or woody streambank cover to small streams increased the numbers of salamanders found in subsequent searches. Habitat differences along mountain streams are important in determining the structure of salamander communities because they can moderate the effects of predation. (Rochester-PTT)
W87-03082

LEAF LITTER PROCESSING AND THE ASSOCIATED INVERTEBRATE FAUNA IN A TALLGRASS PRAIRIE STREAM,
Kansas State Univ., Manhattan. Div. of Biology.
D. L. Smith.
American Midland Naturalist AMNAAF, Vol. 116, No. 1, p 78-86, July 1986. 2 fig, 3 tab, 24 ref. KWRRI/OWRT Grant B-063-KAN.

Descriptors: *Leaf litter, *Invertebrates, *Stream fauna, *Tallgrass prairie, *Kings Creek, Kansas, Leaf packs, Hackberry, Elm, Chinquapin oak, Bur oak, Sycamore, Riffles, Pools, Density, Food, Detritus, Decomposition.

Processing rates and invertebrate colonization of leaf material were measured from November 1980 through April 1981 in a tallgrass prairie stream (Kings Creek, Kansas). Processing rates of artificial leaf packs varied among species (hackberry>elm>chinquapin oak>bur oak>sycamore) and between sites (riffle>pool). Sycamore and bur oak packs were colonized by more invertebrates (primarily collector-scrapers) than were hackberry, elm, and chinquapin oak. Both leaf packs and samples of natural leaf aggregations from riffles contained more organisms (shredders in natural aggregates and collector-scrapers in leaf packs) than did leaf samples from the pools. Differences in invertebrate density between riffle and pool were greater for artificial leaf packs than for natural leaf aggregations. These differences may result from leaf pack construction as well as the natural distribution of leaf material within the stream. In Kings Creek, the slow processing rates, the relatively low densities and diversity of macroinvertebrates, as well as their types and distribution, suggest that (1) leaf material is used more as habitat than as a food source, and (2) macroinvertebrates are not likely to play a major role in degradation of leaf litter. (Author's abstract)
W87-03097

DISSOLVED ORGANIC MATTER IN ANOXIC PORE WATERS FROM MANGROVE LAKE, BERMUDA,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 5A.
W87-03136

ACYCLIC ARCHAEBACTERIAL ETHER LIPIDS IN SWAMP SEDIMENTS,
University of South Florida, St. Petersburg. Dept. of Marine Science.
For primary bibliographic entry see Field 5A.
W87-03141

MATHEMATICAL PREDICTION OF THERMAL STRATIFICATION OF LAKE OSTROVO (VEGORITIS), GREECE,
Thessaloniki Univ., Salonika (Greece). Dept. of Hydraulics.
C. Babajimopoulos, and F. Papadopoulos.
Water Resources Research WRERAO, Vol. 22, No. 11, p 1590-1596, October 1986. 5 fig, 25 ref.

Descriptors: *Lake Ostrovo, *Greece, *Limnology, *Water temperature, *Thermal stratification, *Mathematical analysis, Model studies, Eddy diffusion, Stratification, Hypolimnion, Epilimnion, Temperatures.

A one-dimensional areally averaged model was used for the prediction of the annual vertical temperature profile in Lake Ostrovo (Vegoritis), Greece. Eddy diffusivities were assumed to be given by the product of the eddy diffusivities in the absence of stratification, and a function of a gradient Richardson number. The head exchange between the lake and the atmosphere was formulated by the energy balance approach, and the bottom of the lake was considered to be insulated. The major conclusion of this paper is that a one-dimensionally areally averaged model can be used to adequately describe the stratification process in Lake Ostrovo. The following specific conclusions also apply. (1) the Richardson number formulation for the computation of the eddy diffusivities is adequate for describing the distribution of the heat content in the lake qualitatively. The quantitative success of this formulation requires the determination of the three coefficients theta, gamma and lambda, in the equations K sub o = (theta)(w*), where K sub is the eddy diffusivity in the absence of stratification and w* is the friction velocity of the wind. It was found that higher values of theta result in lower epilimnion temperatures. Coefficient gamma affects only the hypolimnion temperatures. Increasing this coefficient results in the hypolimnion temperature being decreased. Coefficient lambda affects the temperature profile in the opposite way to that of theta. It was found that the values of theta, gamma, and lambda for Lake Ostrovo are theta = 0.0012, gamma = 0.005, and lambda = -0.5, respectively. The temperature profiles obtained by the model are dependent upon the portion of the solar radiation absorbed in the surface layer beta. In Lake Ostrovo, a value of B = 1 seems to be appropriate. (Lantz-PTT)
W87-03198

DISTRIBUTION AND STANDING CROP OF LIVING AND DEAD ROOTS IN THREE WETLAND CAREX SPECIES,
Ithaca Coll., NY. Dept. of Botany.
J. M. Bernard, and K. Fiala.
Torrey Botanical Club Bulletin, Vol. 113, No. 1, p 1-5, January-March, 1986. 1 fig, 2 tab, 26 ref.

Descriptors: *Distribution patterns, *Standing crops, *Roots, *Wetlands, Carex rostrata, Carex trichocarpa, Carex lasiocarpa, Soil profiles, Phenology, Ecosystems.

Living and dead root standing crops of Carex rostrata Stokes, C. trichocarpa Muhl., and C. lasiocarpa Ehrh. were estimated, and their distribution in the soil profile determined. The percentage of living roots in a total root standing crop was relatively low, 11.9-18.8%, while below-ground standing crop values were high, 2237 g/sq , om Carex trichocarpa, 4464 g/sq m in C. rostrata, and 4948 g/sq m in C. lasiocarpa. Living roots contributed less than 600 g/sq m in the three species. Carex rostrata had almost 70% of living roots from 0-10 cm, C. trichocarpa 63.9% from 5-15 cm, and C. lasiocarpa 92% in the 0-5 cm layer of the soil profile. (Author's abstract)
W87-03204

GROWTH AND SURVIVAL OF GIANT RAGWEED (AMBROSIA TRIFIDA L.) IN A DELAWARE RIVER FRESHWATER TIDAL WETLAND,
Rutgers - The State Univ., Camden, NJ. Dept. of Biology.
F. A. Sickels, and R. L. Simpson.
Torrey Botanical Club Bulletin, Vol. 112, No. 4, p 368-375, October-December, 1985. 6 fig, 2 tab, 30 ref.

Descriptors: *Ragweed, *Ambrosia trifida, *Delaware River, *Wetlands, *Plant growth, Plant populations, Tidal marshes, Distribution patterns, Biomass, Plant physiology, Roots.

The survivorship, phenology, production, and distribution of the annual species Ambrosia trifida L. in a Delaware River freshwater tidal wetland, were studied during 1982. Germination began in mid-April with maximum seedling density reached in mid-May. Survivorship exceeded 92% through June and then declined gradually to 23% by late September. Flowers were initiated in late July, with seeds ripening in September. Maximum height (298.8 = or - 33.7 cm/plant) was attained in late September, as was maximum shoot (73.8 + or - 45.6 g/plant) and root (32.7 + or - 37.0 g/plant) biomass. Peak standing crop (3265.6 g/sq m shoot and 1500.9 g/sq m root) occurred in late August. Leaf mortality was 162.1 g/sq m. Net production corrected for leaf loss and survivorship was 6573.8 g/sq m, the highest rate of production yet reported for a freshwater tidal wetland macrophyte. Seed production, estimated in late September, was 12,958 seeds/sq m with 17% showing signs of predation; apparent survival was approximately 1% based on maximum seedling density. Transplant experiments showed that Ambrosia seedlings survived to reproduce in two locations, its normal levee habitat and near the upland forest border, a habitat isolated from a seed source. Transplants did not survive in the stream channels, apparently due to scouring and length of inundation or in the poorly drained high marsh due to lack of tolerance of seedlings to water-logged soils and to shading by other species. Thus, although A. trifida can dominate the levee habitat, its colonization of other habitats seems doubtful. (Author's abstract)
W87-03207

VEGETATION OF THE LOW-SHRUB BOGS OF NORTHERN NEW JERSEY AND ADJACENT NEW YORK: ECOSYSTEMS AT THEIR SOUTHERN LIMIT,
Bergen Community Coll., Paramus, NJ. Div. of Natural Sciences and Mathematics.
L. M. Lynn, and E. F. Karlin.
Torrey Botanical Club Bulletin, Vol. 112, No. 4, p 436-444, October-December, 1985. 1 fig, 2 tab, 27 ref.

Descriptors: *Bogs, *New Jersey, *New York, *Ecosystems, Vegetation, Hydrogen ion concentration, Calcium, Chamaedaphne calyculata, Decodon verticilatus, Kalmia angustifolia, Vaccinium corymbosum, Peat bogs, Ecology.

The vegetation of six low-shrub bogs located near the glacial boundary was quantified using phytosociological methods. Based on pH and Ca ion concentrations, these peatlands were all weakly minerotrophic to ombrotrophic systems. The dominant vascular species were Chamaedaphne calyculata, Decodon verticillatus, Kalmia angustifolia and Vaccinium corymbosum. A number of plant species which are characteristic of northern peatlands and which reach their southern distributional limit in the study region, were absent from the low-shrub bogs studied, although Andromeda glaucophylla and Kalmia polifolia were present. Several species were also present in all of the study sties

which are not usually found in low-shrub bogs located further north. (Author's abstract)
W87-03208

EFFECT OF O2 CONCENTRATION ON DARK H2 OXIDATION IN WHOLE CELLS OF A MARINE SULFUR PHOTOSYNTHETIC BACTERIUM (CHROMATIUM SP. STRAIN MIAMI PBS 1071),
Institute of Physical and Chemical Research, Saitama (Japan).
For primary bibliographic entry see Field 2L.
W87-03211

CHROMATIC REGULATION OF PHOTOSYSTEM COMPOSITION IN THE PHOTOSYNTHETIC SYSTEM OF RED AND BLUE-GREEN ALGAE,
National Inst. for Basic Biology, Okazaki (Japan).
Y. Fujita, K. Ohki, and A. Murakami.
Plant and Cell Physiology PCPHA, Vol. 26, No. 8, p 1541-1548, 1985. 3 fig, 18 ref.

Descriptors: *Photosynthesis, *Cyanophyta, *Red algae, *Light intensity, Chlorophyll a, Phycobilin, Light penetration, Electron transport.

A chromatic adaptation in the photosynthetic quantum yield for the light mainly absorbed by chlorophyll a (Chl a light), was studied with one red and three blue-green algal strains. When the cells were grown under a weak Chl a light, the quantum yield in all strains increased. Comparison of photosystem (PS) compositions, including phycobilin (PBP) and Chl a antennae, reaction centers I and II. In cells grown under the light mainly absorbed by PBP and Chl a, changes in quantum yield could be attributed to changes in the ratio of PS I/II, and becomes larger than 1 under PBP light, but decreases to 1 in most cases under Chl a light. The change in the PS I/II ratio is due solely to the changes in the PS I population in the cell; PS II remains constant. These results are similar to the intensity-dependent response in PS composition. A common hypothesis for both the chromatic and intensity-induced regulation of PS composition was proposed based on the idea of balance between the electron flow from H2O to NADP driven by PS I and II and the cyclic one driven by PS I. (Author's abstract)
W87-03212

CRATER LAKE, OREGON: A RESTRICTED BASIN WITH BASE-OF-SLOPE APRONS OF NONCHANNELIZED TURBIDITES,
Geological Survey, Menlo Park, CA.
For primary bibliographic entry see Field 2J.
W87-03220

REVIEW OF SELECTIVE WITHDRAWAL PERFORMANCE IN THE FORT WORTH DISTRICT,
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 6B.
W87-03229

OPERATIONAL TOOLS: OPTIMAL CONTROL OF RESERVOIR WATER QUALITY,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 5G.
W87-03239

SELECTIVE WITHDRAWAL NEEDS FOR LAKE GREESON ARKANSAS INTAKE STRUCTURE,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 5G.
W87-03242

SELECTIVE WITHDRAWAL STRUCTURE OPERATION EXPERIENCES IN ORD,
Army Engineer Div. Ohio River, Cincinnati.
For primary bibliographic entry see Field 8A.
W87-03243

STUDY ON CHEMICAL BEHAVIOR BETWEEN SEDIMENT AND UPPER WATER,
Yamaguchi Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W87-03251

STATISTICAL ANALYSIS OF THE RELATIONSHIP BETWEEN WATER QUALITY PARAMETERS AND DISCHARGE AT EIGHT STATIONS ON THE RHINE FROM 1959 TO 1974 (ANALYSE STATISTIQUE DES RELATIONS LIANT LES PARAMETRES DE QUALITE D'EAU ET LE DEBIT DU RHIN EN HUIT STATIONS DE 1959 A 1974),
Electricite de France, Chatou.
For primary bibliographic entry see Field 5G.
W87-03282

CHEMICAL MASS BALANCE OF A SMALL BASIN IN A WET MONSOONAL ENVIRONMENT AND THE EFFECT OF FAST-GROWING PLANTATION FOREST,
Vrije Univ., Amsterdam (Netherlands). Inst. voor Aardwetenschappen.
L. A. Bruijnzeel.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 229-239, 3 tab, 27 ref. NFATR (WOTRO) Project No. W76-45.

Descriptors: *Chemical mass balance, *Basins, *Tropical regions, *Plant growth, Vegetation regrowth, Java, Indonesia, Calcium, Magnesium, Sodium, Phosphorus, Silicates, Forests, Nutrients.

A chemical mass balance is presented for a 19 ha basin in central Java (Indonesia) underlain by andesitic tuffs. Net losses of major elements in kg/ha/yr amount to 19.1 (Ca), 26.5 (Mg), 14.1 (Na), 12.4 (K) and 527 (SiO2). Ortho-P accumulates at a rate of 0.2 kg/ha/yr. The vigorously growing vegetation (plantation forests of Agathis dammara) acts as a long-term sink for nutrients, rendering the catchment chemical flux an underestimate of the true chemical denudation rate. Actual immobilization of nutrients by the basin vegetation during the study year was evaluated by determining its biomass and chemical content. Results indicate that the traditional budget approach underestimates the rate of chemical weathering by 75% (ca), 33% (Mg), 17% (Na), 70% (K) and 12% (SiO2). The need to evaluate the role of vegetation in budget studies is stressed. Comparisons with data from other locations are made and applications of the results in land and forest management are suggested. (See also W87-03272) (Author's abstract)
W87-03291

BUDGET OF WATER AND ITS CONSTITUENTS FOR LAKE TAUPO (NEW ZEALAND),
Utrecht Rijksuniversiteit (Netherlands). Dept. of Geography.
C. J. Schouten.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 277-297, 4 fig, 7 tab, 23 ref.

Descriptors: *Hydrologic budget, *Lake Taupo, *New Zealand, *Lake morphology, Water pollution effects, Stream discharge, Chemical analysis, Precipitation, Hydroelectric plants, Nitrogen, Phosphorus.

Outputs of water and its constituents from streams draining into Lake Taupo were investigated over the period 1976-1979. Special attention was given to the effects of volcanic processes and of the activities of man. The water budget showed that about 95% of the outflow of Lake Taupo can be accounted for by surface inflows and direct precipitation to the lake. About 60% of the chloride and sodium cannot be attributed to measurable sources, and is presumably of geothermal origin. Most of these geothermal springs are believed to enter below the lake. Hydroelectric power schemes have resulted in a 16% increase in lake outflow, but not in important changes of the loading of nitrogen and phosphorus components. Further increases in nitrate-N outputs of the basin as a result of agriculture or forestry threatens the trophic status of Lake Taupo. (See also W87-03272) (Author's abstract)
W87-03295

STREAM SOLUTE SOURCES AND VARIATIONS IN A TEMPERATE GRANITE DRAINAGE BASIN,
Plymouth Polytechnic (England). Dept. of Geographical Sciences.
For primary bibliographic entry see Field 5B.
W87-03296

DIFFERENT TECHNIQUES FOR THE COMPUTATION OF RIVER NUTRIENT LOADS (METHODOLOGIES DE QUANTIFICATION DES FLUX DE NUTRIMENTS EN RIVIERE),
Centre National du Machinisme Agricole, du Genie Rural, des Eaux et des Forets, Lyon (France).
P. Balland.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 333-345, 7 fig, 1 tab, 17 ref.

Descriptors: *Nutrients, *Rivers, *Data acquisition, River flow, Chemical analysis, Mathematical analysis, Mathematical studies, Model studies.

The choice of an appropriate technique for quantifying nutrient loads in rivers, depends on the amount of data available for both nutrient concentration C and river flow Q. The following alternatives are discussed: (a) total lack of data for both C and Q; (b) no a priori link considered between C and Q; and (C) a particular relation between C and Q is explicitly assumed, and this approach involves: (i) a stochastic model which gives an estimation of the prediction error, allowing for optimization of th sampling time interval; (ii) a deterministic model which identifies the best C=f(Q) function and then uses it in the computation of loads. A combination of methods (b) and (ii) is described as well. The accuracy of load computation directly dependent on the amount of data available, and the author recommends, when appropriate, comparative testing of the different techniques. (See also W87-03272) (Author's abstract)
W87-03298

ROLE OF DETENTION BASINS FOR STORMWATER QUALITY CONTROL,
Princeton Univ., NJ. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5G.
W87-03301

HEAVY METAL CONTENT IN SEDIMENTS OF LAKES IN SOUTHERN BAVARIA AS A SIGN OF LONG-TERM ENVIRONMENTAL IMPACT,
Munich Univ. (Germany, F.R.). Geographische Inst.
For primary bibliographic entry see Field 5C.
W87-03305

INFLUENCE OF CATASTROPHIC FLOODS ON WATER QUALITY AS RECORDED IN THE SEDIMENTS OF BLAGDON LAKE, ENGLAND,
Polytechnic Wolverhampton (England).
J. P. Smith, S. B. Bradley, M. G. Macklin, and J. J. Cox.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and

Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 421-430, 4 fig, 1 tab, 17 ref.

Descriptors: *Floods, *Water quality, *Lake sediments, *Blagdon Lake, England, Chemical analysis, Water analysis, Heavy metals, Reservoirs, Sedimentology, Magnetic studies.

Studies of the relation between water quality and sediment in Blagdon Reservoir, southwest England, are discussed in the context of varying sources and rates of supply of sediment. Early deposits in the lake are contrasted with later sediments some of which are derived from a major flood in 1968. Selective chemical extractions are shown to be highly effective in discriminating between the binding sites of heavy metals in lake sediments and thus allow the formulation of clearly defined hypotheses about water quality/sediment relationships for Blagdon Reservoir. The sedimentological techniques used distinguish between styles of sedimentation in a way that complements and confirms the reality of changes suggested by chemical and magnetic techniques. They may also suggest ways in which pulsed storm events may be set within the framework of longer term, time-independent (ageing) processes within lake. Magnetic methods, which are relatively rapid and are non-destructive, enable the detailed study of a single core to be extrapolated across a lake basin and provides, in the case of Blagdon, the possibility of investigating sediment chemical and mineralogical characteristics in quantitative sediment influx and deposition rate terms. In addition the mineral magnetic studies enable sediment sources and styles of erosion to be identified. The Blagdon site offers good opportunities for quantitative studies on sediment/water quality relationships, and further work is in progress to this end. (See also W87-03272) (Lantz-PTT)
W87-03306

STATISTICAL METHODS FOR RESERVOIR WATER QUALITY INVESTIGATIONS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 7C.
W87-03322

PRIMARY PRODUCTIVITY (C14) AT TWIN LAKES COLORADO: 1973-81 STUDY RESULTS,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
J. F. LaBounty, S. G. Campbell, and J. J. Sartoris.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB86-233285, A03 in paper copy, A01 in microfiche. Report No. REC-ERC-85-8, December 1985. 35 p, 22 fig, 9 tab, 19 ref, append.

Descriptors: *Primary productivity, *Twin Lakes, *Colorado, *Carbon radioisotopes, *Limnology, Nutrients, Ecology, Carbon, Annual variation, Runoff.

Primary prodactivity and its limiting factors were studied in Twin Lakes, Colorado, during 1973-81, to characterize the lakes limnologically before operations began at the pumped-storage powerplant then under construction on the lower lake. The lakes are a pair of connected, dimictic, montane, drainage lakes of glacial origin. They are classified as oligotrophic. The upper lake receives spring runoff directly, and its volume strongly influences the limnology of both lakes. Both lakes also receive unknown, but limited, amounts of local runoff which - like spring runoff - contains nutrients that support primary production in Twin Lakes. Based on 82 observations, the range of primary production rates in the upper lake is 1 to 104 mg C/(sq m/d). That in the lower lake, based on 86 observations, is 5 to 312 mg C/(sq m/d). The mean daily production rate for the same number of observations from 1973-81 was 33.6 and 63.9 mg C/(sq m/d) for the upper and lower lakes, respectively. The range for oligotrophic lakes, based on the literature, is 50 to 300 mg C/(sq m/d). The average annual productivity over the 9 years of study was 11.3 and 25.8 g C/(sq m/d) for the upper and lower lakes, respectively. The maximum rates of primary production were observed at spring and fall circulation periods. The lowest production rates were observed during winter, under the ice, especially in those years when snow and ice cover were thickest. Runoff transports nutrients that are at other times limited. The years with greatest runoff were observed to have the highest rates of primary production in Twin Lakes. However, these higher rates were observed only in the lower lake, because the increased turbidity and flushing caused by heavy spring runoff severely limits primary production in the upper lake. (Author's abstract)
W87-03326

2I. Water In Plants

EVAPORATION FROM THE UNDERSTOREY IN THE JARRAH (EUCALYPTUS MARGINATA DON EX SM.) FOREST, SOUTHWESTERN AUSTRALIA,
Commonwealth Scientific and Industrial Research Organization, Wembley (Australia). Div. of Groundwater Research.
For primary bibliographic entry see Field 2D.
W87-02679

STUDIES ON H(+)-TRANSLOCATING ATPASES IN PLANTS OF VARYING RESISTANCE TO SALINITY: I. SALINITY DURING GROWTH MODULATES THE PROTON PUMP IN THE HALOPHYTE ATRIPLEX NUMMULARIA,
Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
Y. Braun, M. Hassidim, H. R. Lerner, and L. Reinhold.
Plant Physiology PLPHAY, Vol. 81, No. 4, p 1050-1056, August 1986. 8 fig, 3 tab, 36 ref.

Descriptors: *Salinity, *Halophytes, *Enzymes, *Salt tolerance, *Plant growth, *Translocation, Plant physiology, Plant tissues, Hydrogen ion concentration, Hydrogen ions.

Membrane vesicles were isolated from the halophyte Atriplex nummularia. H(+)-translocating Mg(2+)-ATPase activity was indicated by the establishment of a positive membrane potential and by establishment of a transmembrane pH gradient. H(+)-translocation was highly specific to ATP and was stable to oligomycin. Growing plants in the presence of 400 millimolar NaCl doubled proton translocation activity per milligram of membrane protein and modulated it as follows: (1) the flat pH profile in non-salt-grown plants was transformed to one that peaked at pH 6.2; (2) the lag effect observed at low ATP concentration was abolished and the concave curvature shown in the double reciprocal plot was diminished; (3) sensitivity to (N-morpholino)ethanesulfonic acid was apparent in salt-grown plants but was absent in non-salt-grown plants; and, (4) the KCl concentration causing 50% dissipation of ATP-dependent SCN(-) accumulation was 20 millimolar for salt-grown plants as compared with 50 millimolar for the non-salt-grown. Vanadate sensitivity was apparent in both cases and no clear NO3(-) was observed. (See also W87-02718) (Author's abstract)
W87-02717

STUDIES ON H(+)-TRANSLOCATING ATPASES IN PLANTS OF VARYING RESISTANCE TO SALINITY: II. K(+) STRONGLY PROMOTES DEVELOPMENT OF MEMBRANE POTENTIAL IN VESICLES FROM COTTON ROOTS,
Hebrew Univ., Jerusalem (Israel). Dept. of Botany.
M. Hassidim, Y. Braun, H. R. Lerner, and L. Reinhold.
Plant Physiology PLPHAY, Vol. 81, No. 4, p 1057-1061, August 1986. 7 fig, 5 tab, 12 ref.

Descriptors: *Salinity, *Plant growth, *Translocation, *Enzymes, *Salt tolerance, *Membrane potential, *Vesicles, *Cotton, Hydrogen ions, Potassium ions, Hydrogen ion concentration, Plant physiology, Plant tissues.

Mg(2+)-ATP-dependent H(+)-translocation was studied in the membrane vesicles derived from a cotton plant. A positive membrane potential was established and SCN(-) accumulation was measured. The change in pH across the vesicle was established by measuring quinacrine fluorescence quenching. High specificity for ATP was evidenced and H(+)-translocation was oligomycin stable. The pH profile for H(+)-translocation showed an optimum at 5.5. The relationship between SCN(-) accumulation and ATP concentration was approximately Michaelian and (N-morpholino)ethanesulfonic acid strongly promoted ATP-dependent SCN(-) uptake. Carbonyl cyanide p-trifluoromethoxyphenylhydrazone totally inhibited SCN(-) accumulation. Vanadate at 200 micromolar inhibited SCN(-) uptake by about 10 to 40% withhout K(+), but was stronger in its presence. NO3(-) at 100 millimolar inhibited the initial rate of quinacrine quenching. The NO3(-) insensitive fraction was activated by K(+) and was inhibited by 200 micromolar vanadate to about 40% if K(+) were present. Saline conditions during plant growth had no appreciable effect on the observed effects of H(+)-translocation. (See also W87-02717) (Michael-PTT)
W87-02718

DISTRIBUTE WATER EFFECTIVELY,
For primary bibliographic entry see Field 3F.
W87-02760

PLAINS COTTONWOOD RECRUITMENT AND SURVIVAL ON A PRAIRIE MEANDERING RIVER FLOODPLAIN, MILK RIVER, SOUTHERN ALBERTA AND NORTHERN MONTANA,
Calgary Univ. (Alberta). Dept. of Geography.
C. E. Bradley, and D. G. Smith.
Canadian Journal of Botany CJBOAW, Vol. 64, No. 7, p 1433-1442, July 1986. 7 fig, 3 tab, 18 ref.

Descriptors: *Cottonweed trees, *Survival, *Prairies, *Meanders, *Rivers, *Flood plains, *Milk River, Alberta, *Flood plain management, Trees, Distribution, Population density, Density, Plant populations, Hydrology, Sedimentation, Temporal distribution, Dams, Sedimentation rates, Seeds.

Age, distribution, and density of two populations of plains cottonwood (Populus deltoides var. occidentalis) on the floodplain of the Milk River, southern Alberta and northern Montana, were studied in relation to historical river hydrology and sedimentation regimes. In Alberta, cottonwood recruitment leading to long-term survival on river meander lobes (point bars) correlates with years when daily maximum flows during the period of seed dispersal (June 1 to July 10) attain a stage equal to or greater than the two-year return flood, based on the annual flood series. Such flood events during the seed dispersal period recur an average of once in five years. In Montana, on the floodplain for 25 km downstream of Fresno Dam, the densities of cottonwoods recruited since 1939, when the dam was constructed, are significantly lower than on floodplain sites upstream, in Alberta. Results suggest that this is due to a marked reduction in flood magnitude and frequency, rates of sedimentation, and meander migration. It is concluded that the prospects for cottonwood survival on floodplains downriver from dams in this and other prairie river valleys are not encouraging unless management measures are taken to reverse the trend. (Author's abstract)
W87-02769

CLASSIFICATION OF MACROPHYTES IN BODIES OF WATER AND OF AQUATIC VEGETATION,
All-Union Scientific Research Inst. of Game Management and Fur Breeding, Volga (USSR).
For primary bibliographic entry see Field 2H.
W87-02772

SALT TOLERANCE IN THE TRITICEAE: SALINITY-INDUCED CHANGES IN THE LEAF

SOLUTE COMPOSITION OF SOME PERENNIAL TRITICEAE,
University Coll. of North Wales, Bangor. Centre for Arid Zone Studies.
J. Gorham, E. Budrewicz, E. McDonnell, and R. G. Jones.
Journal of Experimental Botany, Vol. 37, No. 181, p 1114-1128, August 1986. 1 fig, 7 tab, 58 ref.

Descriptors: *Salt tolerance, *Grasses, *Salinity, *Leaves, *Solutes, *Plant physiology, Sodium, Chlorides, Accumulation, Nitrates, Nitrogen, Nitrogen compounds.

Changes in the leaf solute composition in response to salinity are described in a number of perennial grasses of the tribe Triticeae. Variation was found both within and between species in the extent of Na and Cl accumulation in the leaves. In almost all cases, leaf nitrate concentrations decreased substantially in response to salinity, while orthophosphate concentrations increased. There was no overall decrease in a range of soluble nitrogen-containing compounds nor in total nitrogen. In Thinopyrum scirpeum, there was an inverse relationship between proline and glycinebetaine contents of different tissues, with proline levels higher in older leaves. Concentrations of both compounds were higher in salt-stressed plants. (Author's abstract)
W87-02785

RELATIONSHIPS AMONG GROWTH RATE, CELLULAR MANGANESE CONCENTRATIONS AND MANGANESE TRANSPORT KINETICS IN ESTUARINE AND OCEANIC SPECIES OF THE DIATOM THALASSIOSIRA,
National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.
For primary bibliographic entry see Field 2L.
W87-02805

EFFECTS OF TEMPERATURE, SALINITY, IRRADIANCE AND DIURNAL PERIODICITY ON GROWTH AND PHOTOSYNTHESIS IN THE DIATOM NITZSCHIA AMERICANA: LIGHT-SATURATED GROWTH,
North Carolina State Univ. at Raleigh. Dept. of Marine, Earth and Atmospheric Sciences.
For primary bibliographic entry see Field 2L.
W87-02807

EFFECTS OF CURRENT VELOCITY AND LIGHT ENERGY ON THE STRUCTURE OF PERIPHYTON ASSEMBLAGES IN LABORATORY STREAMS,
Oregon State Univ., Corvallis. Dept. of Botany and Plant Physiology.
For primary bibliographic entry see Field 2H.
W87-02808

EFFECTS OF LIGHT ON GROWTH, RUBPCASE ACTIVITY AND CHEMICAL COMPOSITION OF ULVA SPECIES (CHLOROPHYTA),
Duke Univ., Beaufort, NC. Marine Lab.
For primary bibliographic entry see Field 2L.
W87-02809

EFFECT OF CULTIVATED AND WILD RICE VARIETIES ON THE NITROGEN BALANCE OF FLOODED SOIL,
Boyce Thompson Inst. for Plant Research, Ithaca, NY.
A. A. App, I. Watanabe, T. S. Ventura, M. Bravo, and C. D. Jurey.
Soil Science SOSCAK, Vol. 141, No. 6, p 448-452, June 1986. 1 tab, 16 ref.

Descriptors: *Cultivation, *Rice, *Nitrogen cycle, *Saturated soils, *Soil science, *Soil-water-plant relationships, Crop production, Agronomy, Nitrogen, Nitrogen fixation, Nutrients.

Cultivated rice (76 varieties), seven wild species of Oryza, and two aquatic weeds were examined for their ability to enhance biological nitrogen fixation (BNF). Plants were found to differ significantly in their capacity to support a positive nitrogen balance. Nitrogen balance figures for a specific variety may vary considerably between experiments. Statistical analysis indicates a high correlation with nitrogen uptake. N balance and total dry weight were also correlated, with high plant biomass associated with a positive N balance; this may reflect the derepression of soil BNF through depletion of available N by a vigorous root system. Nitrogen balance experiments are tedious and time-consuming. The correlation between nitrogen balance and other properties should be explored to provide a simple screening procedure suitable for rice improvement programs. (Doria-PTT)
W87-02813

ALCOHOL DEHYDROGENASE ACTIVITY IN THE ROOTS OF MARSH PLANTS IN NATURALLY WATERLOGGED SOILS,
John Innes Inst., Norwich (England).
A. M. Smith, C. M. Hylton, L. Koch, and H. W. Woolhouse.
Planta PLANAB, Vol. 168, No. 1, p 130-138, May 1986. 1 fig, 5 tab, 27 ref.

Descriptors: *Enzymes, *Dehydrogenase, *Roots, *Marsh plants, *Saturated soils, *Plant physiology, *Soil-water-plant relationships, Aquatic plants, Marshes, Wetlands, Soil types, Metabolism, Fermentation, Flooding, Anaerobic conditions.

Marsh plants in flooded soil were studied to determine whether oxygen tensions in the roots would be high enough to allow fully anaerobic metabolism. Activity of alcohol dehydrogenase (ADH), synthesized in anoxic plants, was measured in roots of marsh plants growing in habitats where the availability of oxygen to the roots would be expected to differ. Results differed considerably among species. Ethanol was the major product of fermentation in roots of all species studied; there was no correlation between ADH activity and the rate of ethanol production under anoxia of Urtica roots. The physiological significance of high ADH activities in roots is thus unclear. (Author's abstract)
W87-02816

ROOT DISTRIBUTION AND WATER UPTAKE PATTERNS OF MAIZE CULTIVARS FIELD-GROWN UNDER DIFFERENTIAL IRRIGATION,
Ife Univ. (Nigeria).
P. O. Aina, and H. O. Fapohunda.
Plant and Soil PLSOA2, Vol. 94, No. 2, p 257-265, 1986. 5 fig, 1 tab, 19 ref.

Descriptors: *Root distribution, *Water use, *Corn, *Irrigation, *Soil-water-plant relationships, Crop yield, Roots, Drought resistance, Permeability coefficient, Growth, Soil water, Water potentials.

Rooting and water uptake patterns were determined for three maize varieties field-grown during the 1983-84 dry season under seven irrigation levels on a sandy loam soil. Roots were mainly concentrated in the top 22 cm due to a 40 cm thick compact gravelly layer occurring from about this depth in the profile. There were significant varietal differences, distinguished by root length density (RLD) and length/weight ratio (LAR) distributions at depth and at varying soil moisture regimes. These properties were related to water extraction patterns and grain yields. Better performance of var 1 was attributed to the development of a more active and deep rooting system. (Author's abstract)
W87-02817

EFFECTS OF FREQUENCY OF IRRIGATION ON NUTRIENT UPTAKE OF APPLE TREES,
Department of Agriculture, Summerland (British Columbia). Research Station.
For primary bibliographic entry see Field 3F.
W87-02875

SNOW AND FERTILIZER MANAGEMENT FOR CONTINUOUS ZERO-TILL SPRING WHEAT,
Department of Agriculture, Swift Current (Saskatchewan). Research Station.
For primary bibliographic entry see Field 3F.
W87-02879

RESPONSE OF LETTUCE CULTIVARS TO SLUDGE-AMENDED SOILS AND BED TYPES,
Wisconsin Univ.-Madison. Dept. of Horticulture.
For primary bibliographic entry see Field 3C.
W87-02880

CHARACTERIZATION AND CLASSIFICATION OF SEASIDE-SALT-MARSH SOILS ON VIRGINIA'S EASTERN SHORE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
For primary bibliographic entry see Field 2L.
W87-02919

WHEAT RESIDUE MANAGEMENT EFFECTS ON SOIL WATER STORAGE AND CORN PRODUCTION,
Agricultural Research Service, Bushland, TX. Conservation and Production Lab.
For primary bibliographic entry see Field 3F.
W87-02924

TECHNIQUES FOR WATER-USE MEASUREMENTS OF CROP PLANTS,
Kansas Agricultural Experiment Station, Manhattan. Evapotranspiration Lab.
For primary bibliographic entry see Field 7B.
W87-02949

TECHNIQUES FOR MEASURING PLANT WATER,
Illinois Univ. at Urbana-Champaign. Dept. of Horticulture.
For primary bibliographic entry see Field 7B.
W87-02950

METHODS OF INDUCING WATER STRESS IN PLANTS,
D. T. Krizek.
Hortscience, Vol. 20, No. 6, p 1028-1038, December 1985. 2 fig, 1 tab, 206 ref.

Descriptors: *Water stress, *Soil water, *Plant water potential, *Osmosis, *Water deficit, Permeability coefficient, Sodium chloride, Polyethylene glycol, Mannitol, Sorbitol, Dextran, Toxicity, Membrane processes, Roots, Water deficit, Irrigation, Agriculture.

The relative advantages and disadvantages of withholding water and using osmotic agents to induce plant water stress are discussed. Water withholding treatments are more natural, but are difficult to quantify unless pre-selected criteria for end points are established. A system for imposing water stress by controlling water column height and/or hydraulic conductivity is the most promising method to date for inducing long term water stress. Osmotic agents such as NaCl, polyethylene glycol, mannitol, sorbitol and dextran induce more rapid and precise levels of osmotic stress, but often have toxic side effects. The use of a membrane system to separate the osmotic agent from the root system may eliminate these side effects, but this method is limited to short term studies due to membrane degradation. The use of osmotic agents may cause inadvertent stress effects from the osmoticum itself, and caution must be exercised in drawing conclusions from one method alone. Use of membranes to separate roots from osmotic agents in short term studies and adjustment of the water column in long term studies are likely to be used in future investigations of water stress, particularly in those species sensitive to the toxic effects of osmotic agents. (Michael-PTT)
W87-02951

INTEGRATION OF WATER STRESS IN FRUIT TREES,
Agricultural Research and Education Center, Lake Alfred, FL.

J. P. Syvertsen.
Hortscience, Vol. 20, No. 6, p 1039-1043, December 1985. 2 fig, 1 tab, 78 ref.

Descriptors: *Water stress, *Fruit crops, *Crop yield, Flooding, Drought, Plant growth, Carbon cycle, Plant physiology, Productivity, Roots, Irrigation, Agriculture.

A mild degree of water stress probably has little effect on fruit crop yield, since even horticultural crops are seldom in a completely unstressed condition. The extent to which moderate drought or flooding stress decrease crop yield and quantity depends on the plant species and phenological stage of vegetative and reproductive growth. It is difficult to formulate useful generalizations that apply to integration of water stress responses within a plant system. Some generalizations regarding particular plant systems are possible, but are often only applicable to specific crops. Further research on interactions among plant nutrition, hormone balance, drought stress and the integration of these factors in the whole plant system should lead to more useful interpretations of how water and carbon budgets affect plant productivity. (Michael-PTT)
W87-02952

REMOTE SENSING TECHNIQUES FOR ASSESSING WATER DEFICITS AND MODELING CROP RESPONSE,
Kansas Agricultural Experiment Station, Manhattan. Evapotranspiration Lab.
For primary bibliographic entry see Field 7B.
W87-02953

RECYCLING IRRIGATION RUNOFF ON CONTAINER ORNAMENTALS,
Monrovia Nursery Co., Azusa, CA.
For primary bibliographic entry see Field 3F.
W87-02956

WATER CONSERVATION AND RECYCLING IN ORNAMENTALS PRODUCTION,
California Univ., Davis. Cooperative Extension.
For primary bibliographic entry see Field 3F.
W87-02957

INTERACTIVE EFFECTS OF SEWAGE EFFLUENT IRRIGATION AND SUPPLEMENTAL FERTILIZATION ON CONTAINER-GROWN TREES,
Fort Lauderdale Research and Education Center, FL.
For primary bibliographic entry see Field 3C.
W87-02958

RATE OF WATER LOSS FROM DETACHED LEAVES OF DROUGHT RESISTANT AND SUSCEPTIBLE GENOTYPES OF COWPEA,
Texas A and M Univ., College Station. Dept. of Horticultural Sciences.
D. W. Walker, and J. C. Miller.
Hortscience, Vol. 21, No. 1, p 131-132, February 1986. 1 fig, 2 tab, 5 ref.

Descriptors: *Leaves, *Cowpea, *Water loss, *Drought resistance, Adaptation, Water stress, Genotypes, Cuticular transpiration.

A relatively simple procedure for estimating water retention capacity of detached leaves offers the possibility of identifying genotypes possessing this specific drought adaptation trait. Cuticular resistance to water loss was estimated for drought resistant and susceptible genotypes of cowpea. The procedure consisted of detaching the youngest, fully expanded trifoliate leaf of a well-watered plant and drying it under ambient air conditioning and oven conditions. Both genotypes consistently expressed increased or reduced leaf water content 48 hours after detachment. Named cultivars generally had even higher leaf water content values after drying than did selected resistant genotypes. Interspecific variability appears to exist and may be related to drought adaptation in cowpea. (Michael-PTT)
W87-02960

ROOT SYSTEMS IN RELATION TO STRESS TOLERANCE,
Agricultural Research Service, Prosser, WA. Irrigated Agriculture Research and Extension Center.
D. E. Miller.
Hortscience, Vol. 21, No. 4, p 963-970, August 1986. 6 fig, 3 tab, 104 ref.

Descriptors: *Roots, *Water stress, *Drought resistance, Absorption, Translocation, Synthesis, Flooding, Oxygen depletion, Nutrients, Temperature effects, Porosity, Stomata, Leaves, Plant morphology.

Root functions can be affected by stresses such as inadequate or excess water, oxygen deficiency, inadequate or unbalanced nutrients, adverse temperatures, mechanical impedance, toxic chemicals or attack by pathogens or insects. Many of these factors interact and an attack by any one may affect the plant's response to several other factors. Higher plants have mechanisms to cope with the various stresses, including an expanding root system, change in root to shoot ratio, development of additional adventitious roots and internal pore space, stomata opening control, adjustment of leaf water potential and changes in morphology. Many of these adaptations allow plant survival under adverse conditions, but plant yield or quality may be reduced to below that of what might be expected under optimal growth conditions. (Michael-PTT)
W87-02961

DIFFERENTIAL SENSITIVITY OF TURFGRASS ORGANS TO WATER STRESS,
Iowa State Univ., Ames. Dept. of Horticulture.
J. L. Nus, and C. F. Hodges.
Hortscience, Vol. 21, No. 4, p 1014-1015, August 1986. 2 tab, 17 ref.

Descriptors: *Water stress, *Turf grasses, *Plant growth, Osmosis, Plant tissues, Rhizomes, Roots.

The effect of environmental stress on the growth and physiology of grasses adapted to turf is a major factor in their culture. The recovery by Kentucky bluegrass from heavy use and production of both tillers (intravaginal branches) and rhizomes (extravaginal branches) has made it the most widely used cool-season species adapted to turf culture. The sensitivity of various organs of Kentucky bluegrass to osmotically induced water stress was evaluated. Lateral bud meristems were most sensitive to osmotic pressure increases and decreased bud development resulted in a decrease in tiller and rhizome numbers. Relative growth rates of various organs also established that shoot dry matter loss in response to water stress was due to decreased tiller and rhizome growth. Increasing osmotic pressure had similar but less severe effects on leaf and root growth. The use of relative growth for characterizing growth responses to water stress is also discussed. (Michael-PTT)
W87-02962

INFLUENCE OF CLIMATIC FACTORS AND FORAGE AGE ON THE CHEMICAL COMPONENTS OF RYEGRASS RELATED TO GRASS TETANY,
Louisiana Agricultural Experiment Station, Baton Rouge.
D. J. R. Cherney, and D. L. Robinson.
Agronomy Journal AGJOAT, Vol. 77, No. 6, p 827-830, November-December 1985. 3 tab, 26 ref.

Descriptors: *Climatic conditions, *Forages, *Chemical composition, *Tissue analysis, *Ryegrass, *Hypomagnesemia, Temperature effects, Soil water, Plant growth, Vegetation regrowth, Magnesium, Calcium, Potassium, Nitrogen, Carbohydrates, Aluminum.

The effects of growth temperature, soil moisture level, length of flooded period and forage age on forage chemical parameters associated with the incidence of grass tetany were evaluated. Annual ryegrass grown at two day/night temperatures, two soil moisture levels and three flooded periods was harvested at 35, 42 and 49 days after planting. Regrowth tissue was harvested on day 49 from plants harvested on days 35 and 42. Temperature and moisture variables were initiated 21 days after planting in a silty clay collected from a tetany-prone pasture. Rye grass exposed to 5-0 C for two weeks contained less than the critical magnesium level while that exposed to 21-13 C always contained more than the critical level. Concentrations of Mg, Ca, K and N were higher in younger than older plant tissues and higher in regrowth than in first growth tissue. Regrowth tissue produced at low temperature contained low levels of magnesium and very low levels of total water soluble carbohydrate. Although soil moisture effects were minimal, magnesium concentrations were lower under flooded soil conditions. Forage aluminum concentrations were not affected by environmental conditions or forage age at harvest which indicated that aluminum level was not a factor in determining tetany potential of ryegrass under these conditions. This study demonstrates that grass tetany potential is higher after cold, wet periods and that young regrowth tissue can increase that potential. (Michael-PTT)
W87-02980

SOIL COMPACTION AND MOISTURE STRESS PRECONDITIONING IN KENTUCKY BLUEGRASS. I. SOIL AERATION, WATER USE, AND ROOT RESPONSES,
Iowa State Univ., Ames. Dept. of Horticulture.
For primary bibliographic entry see Field 2G.
W87-02982

SOIL COMPACTION AND MOISTURE STRESS PRECONDITIONING IN KENTUCKY BLUEGRASS. II. STOMATAL RESISTANCE, LEAF WATER POTENTIAL, AND CANOPY TEMPERATURE,
Iowa State Univ., Ames. Dept. of Horticulture.
For primary bibliographic entry see Field 2G.
W87-02983

ROOT CONTROL OF LEAF PHOSPHORUS AND CHLORINE ACCUMULATION IN SOYBEAN UNDER SALINITY STRESS,
Agricultural Research Service, Riverside, CA. Salinity Lab.
S. R. Grattan, and E. V. Maas.
Agronomy Journal AGJOAT, Vol. 77, No. 6, p 890-895, November-December 1985. 7 tab, 26 ref.

Descriptors: *Roots, *Phosphorus, *Chlorine, *Soybeans, *Salinity stress, Translocation, Rootstocks, Leaves, Toxicity, Accumulation, Plant tissues, Plant physiology.

The role of scion and rootstock in leaf P and Cl accumulation and foliar injury with reciprocally grafted soybean was evaluated. Four genotypes were selected based on P and Cl exclusion/accumulation potential and root-scion grafts of all combinations of the four cultivars were tested. Visual foliar injury and its onset, severity and symptoms were predominantly controlled by rootstock genotype and correlated with leaf P and Cl concentration. Scions of all four genotypes when grafted on rootstocks that translocated P and Cl to the shoots were senstive to P and Cl. Leaf injury characteristics varied among the rootstocks and was attributed to toxicity from either P or Cl or in combination. Scions of one rootstock remained healthy during the entire experiment. Although leaf P and Cl accumulation were controlled by rootstock genotype, an additional, unidentified mechanism was found in the scion of two genotypes that reduced leaf P and Cl concentration. The contribution of this mechanism was insufficient to delay an onset of foliar injury. (Michael-PTT)
W87-02984

RESPONSES OF SUGARBEET TO DEFICIT, HIGH-FREQUENCY SPRINKLER IRRIGATION. I. SUCROSE ACCUMULATION, AND TOP AND ROOT DRY MATTER PRODUCTION,
Washington State Univ., Pullman.
For primary bibliographic entry see Field 3F.
W87-02985

RESPONSES OF SUGARBEET TO DEFICIT, HIGH-FREQUENCY SPRINKLER IRRIGATION. II. SUGARBEET DEVELOPMENT AND PARTITIONING TO ROOT GROWTH,
Washington State Univ., Pullman.
For primary bibliographic entry see Field 3F.
W87-02986

MANAGEMENT OF SORGHUM UNDER LIMITED IRRIGATION,
Agricultural Research Service, Bushland, TX.
For primary bibliographic entry see Field 3F.
W87-02987

SALINITY TOLERANCE OF WINGED BEAN AS COMPARED WITH THAT OF SOYBEAN,
Maryland Univ., College Park.
For primary bibliographic entry see Field 3C.
W87-02988

SOIL WATER BALANCE OF INTERCROPPED MAIZE AND COWPEA GROWN IN A TROPICAL HYDROMORPHIC SOIL IN WESTERN NIGERIA,
International Inst. of Tropical Agriculture, Ibadan (Nigeria). Farming Systems Program.
N. R. Hulugalle, and R. Lal.
Agronomy Journal AGJOAT, Vol. 78, No. 1, p 86-90, January-February 1986. 1 fig, 7 tab, 20 ref.

Descriptors: *Soil water, *Corn, *Hydromorphic soils, *Nigeria, Evapotranspiration, Roots, Permeability coefficient, Water use efficiency, Tropical regions, Drought, Crop production, Cropland, Planting management.

Water use efficiency and soil water extraction by four maize and cowpea cropping patterns were studied in a tropical hydromorphic soil over two consecutive growing seasons. Cropping patterns included monocropped cowpea and maize, intercropped maize and cowpea planted in the same row as alternate plants and intercropped maize and cowpea planted in alternate rows. Evapotranspiration was calculated from the soil water balance. Soil water extraction was limited to the surface 0.35 meters because of root restriction by a gravel layer. Upward water flux into the root zone was negligible due to low hydraulic conductivity. All cropping patterns were subjected to drought in 1983. Intercropping increased seasonal water use efficiency during both the drought year and a favorable moisture regime the following year. One of the benefits of intercropping compared to monocropping is a higher water efficiency if the soil water is not limiting. (Author's abstract)
W87-02989

EFFECT OF STANDING SMALL GRAIN STUBBLE ON SNOW COVER CHARACTERISTICS IN ALTERNATE FALLOW STRIP CROPPING,
Montana State Univ., Bozeman. Dept. of Plant and Soil Science.
For primary bibliographic entry see Field 2C.
W87-02990

USE OF PORTABLE RAINOUT SHELTERS TO INDUCE WATER STRESS,
Nebraska Univ.-Lincoln. Dept. of Agronomy.
K. L. Clawson, B. L. Blad, and J. E. Specht.
Agronomy Journal AGJOAT, Vol. 78, No. 1, p 120-123, January-February 1986. 6 fig, 14 ref. USDA-SEA-CSRS Grant 901-15-38.

Descriptors: *Water stress, *Rainout shelters, *Evapotranspiration, *Microclimates, Soybeans, Measuring instruments, Biomass, Water conservation, Leaves, Temperature effects, Soil water, Field tests.

The feasibility of using portable rainout shelters in water stress studies was evaluated using three near-isogenic lines of soybean differing in pubescence density. Soybean isolines were planted in small plots that were either rainfed or rainout sheltered. The plots were instrumented with leaf thermocouples, strip net radiometers and neutron access tubes. Phytomass and leaf area index measurements were taken from small sheltered plots and four adjacent large rainfed plots. Leaf temperature was warmer and net midday radiation was lower in the sheltered plots. The shelters induced water stress as indicated by a rise in leaf temperature, but significant lateral and/or upward soil water movement into the sheltered plots reduced the effectiveness of the shelters. Phytomass accumulation and leaf area index from small and large plots did not agree. Estimate errors in the small plots were much greater than those from large plots. Because of these problems, the use of small, portable rainout shelters is not recommended. (Author's abstract)
W87-02991

GROWTH AND YIELD OF SUNFLOWER AND SOYBEAN UNDER SOIL WATER DEFICITS,
Oregon State Univ., Corvallis.
W. J. Cox, and G. D. Jolliff.
Agronomy Journal AGJOAT, Vol. 78, No. 2, p 226-230, March-April 1986. 5 fig, 2 tab, 24 ref.

Descriptors: *Sunflower, *Soybeans, *Plant growth, *Evapotranspiration, *Assimilation rate, *Crop yield, *Soil water, *Water deficit, Sprinkler irrigation, Leaves, Agriculture, Cultivation, Anthesis, Water use, Water use efficiency, Dry matter.

Crop growth, seed yield and water extraction patterns were compared to characterize sunflower and soybean crop responses to moderate and severe soil water deficits. Line source spinkler designs were used to generate well-irrigated, deficit-irrigated and dryland treatments. In the well-irrigated treatments, soybean and sunflower produced comparable dry matter and seed yields. Soil water deficits reduced dry matter production and seed yield in the deficit and dryland treatments. Sunflower leaf area index and seeds per plant were the characteristics most sensitive to soil water deficit, while harvest index was unaffected. Soybean leaf area index and net assimilation rate were reduced and pod number was most sensitive to soil water deficit. Dryland sunflower extracted water at a greater depth and avoided severe water stress during its reproductive period. Dryland soybean depleted less soil water at this depth thus suffering severe water stress during reproduction which lowered its harvest index and seed yield. This study confirms that sunflower may tolerate prolonged drought better than soybean by extracting water deeper in the soil profile. (Author's abstract)
W87-02992

KLEINGRASS YIELD AND QUALITY UNDER THREE IRRIGATION REGIMES WHEN HARVESTED AT ANTHESIS,
New Mexico State Univ., Las Cruces. Dept. of Crop and Soil Sciences.
For primary bibliographic entry see Field 3F.
W87-02993

INTERACTIVE EFFECTS OF NITROGEN AND WATER STRESSES ON WATER RELATIONS OF FIELD-GROWN CORN LEAVES,
Florida Univ., Gainesville. Dept. of Agronomy.
J. M. Bennett, J. W. Jones, B. Zur, and L. C. Hammond.
Agronomy Journal AGJOAT, Vol. 78, No. 2, p 273-280, March-April 1986. 7 fig, 1 tab, 23 ref.

Descriptors: *Nitrogen, *Water stress, *Corn, *Transpiration, Leaves, Sandy soils, Osmosis, Stomatal resistance, Soil water.

The interactive effects of water and N stresses on leaf water potential components, transpiration rate and stomatal resistance of field-grown corn leaves was studied. Corn grown on a fine sand soil was subjected to optimal irrigation and a 10-day water stress period that preceded 50% silking. Two nitrogen levels were imposed within each treatment. Midday and diurnal measurements of leaf water potential, osmotic potential, turgor potential, transpiration and leaf diffusive resistance were taken during the water stress period on combinations of the water and N stress treatments. High-N plants maintained lower stomatal resistances at the lower leaf water potential and extracted more water from lower depths in the soil profile than low-N plants. Lower osmotic potential and leaf water potential resulted in higher turgor potential in high-N plants which was probably responsible for the lower stomatal resistances and higher transpiration rates that were observed. Lower leaf osmotic potential of the water-stressed, high-N plants could have caused more efficient water extraction from the soil profile. High-N plants were affected less by water stress as evidenced by the maintenance of turgor potential, open stomata and higher individual leaf transpiration rates despite similar reductions in leaf water potential during period of low soil water availability. (Michael-PTT)
W87-02994

IRRIGATION EFFECTS ON AGRONOMIC CHARACTERS OF MEADOWFOAM,
Colorado State Univ., Grand Junction. Fruita Research Center.
For primary bibliographic entry see Field 3F.
W87-02995

YIELD AND PHYSIOLOGICAL RESPONSES OF POTATOES TO DEFICIT, HIGH FREQUENCY SPRINKLER IRRIGATION,
For primary bibliographic entry see Field 3F.
W87-02997

ESTIMATION OF SPRING WHEAT SPIKE WATER CONCENTRATION AND GRAIN MATURITY FROM AIR TEMPERATURE,
Science and Education Administration, Mandan, ND. Northern Great Plains Research Center.
A. Bauer, A. B. Frank, and A. L. Black.
Agronomy Journal AGJOAT, Vol. 78, No. 3, p 445-450, May-June 1986. 3 fig, 4 tab, 18 ref.

Descriptors: *Wheat, *Windrowing, *Grain, *Mature growth stage, *Water conservation, *Crop yield, Algorithms, Agriculture, Regression analysis, Estimating, Plant growth, Model studies, Planting management.

A three-part, five year study was conducted to develop algorithms for estimating the earliest time of windrowing from growing degree days accumulated after anthesis of spring wheat and to evaluate the water conservation benefits of earliest possible windrowing. Spike water concentration and content were measured in five trials with variables including cultivars, water and fertility, and regressed on the growing degree days (GDD) from anthesis to grain maturity. The interrelationships of spike, grain and chaff water were determined. The effect of spike water concentration at windrowing was measured in three trials. Cumulative GDD accounted for 90% of the variability in spike water concentration and 49% of the variability in spike water content among all treatments. Spike water concentration was inversely related to grain dry matter assimilation. Spike water content reached a maximum at 200 to 600 GDD after anthesis and then declined sharply. Spring wheat windrowed at spike water concentrations achieved at about 670 GDD after anthesis did not adversely affect grain yield or grain N concentration. Windrowing as early as possible enhances water conservation potential with the primary benefit accruing to an autumn-planted crop. (Author's abstract)
W87-02998

GAS EXCHANGE OF FIELD-GROWN SOYBEAN UNDER DROUGHT,
P. M. Cortes, and T. R. Sinclair.
Agronomy Journal AGJOAT, Vol. 78, No. 3, p 454-458, May-June 1986. 3 fig, 2 tab, 10 ref.

Descriptors: *Gas exchange, *Soybeans, *Transpiration, *Drought, *Water stress, Carbon, Leaves, Water vapor, Reproducibility, Flowering, Photosynthesis.

The relative effects of drought stress and leaf carbon exchange rates (CER) on seasonal accumulation of C by soybean were assessed for field grown plants. Leaflet CER and water vapor ex-

change rates were continuously measured during drought stress treatments of two indeterminate cultivars that differed in maturity. Gas exchange measurements were taken using an open system with assimilation chambers enclosing the uppermost fully expanded leaflets. Data were recorded concurrently every 12 minutes for leaflets attached to plants in an irrigated treatment and in treatments drought stressed at different stages of reproductive growth. The CER of cultivars experiencing drought during reproductive growth was reduced by 25% for the remainder of the growing season. Drought during flowering to mid-podfill did not seem to hasten leaf senescence in either cultivar. Drought after mid-podfill resulted in a five to ten day earlier leaf senescence of leaves at the top nodes of the plants. These data suggest that reduced CER for the remainder of the season was a consistent result of drought stress during reproductive growth. Hastened leaf senescence could further reduce total accumulated carbon if drought occurs late in reproductive growth. (Michael-PTT)
W87-02999

WATER USE EFFICIENCY IN SOYBEAN PUBESCENCE DENSITY ISOLINES-A CALCULATION PROCEDURE FOR ESTIMATING DAILY VALUES,
Nebraska Univ.-Lincoln. Dept. of Agronomy.
K. L. Clawson, J. E. Specht, B. L. Blad, and A. F. Garay.
Agronomy Journal AGJOAT, Vol. 78, No. 3, p 483-487, May-June 1986. 4 fig, 16 ref. USDA-SAE-CSRS Grant 901-15-38.

Descriptors: *Water use efficiency, *Soybeans, *Estimating, *Plant growth, *Evapotranspiration, *Isolines, Photosynthesis, Density, Plant physiology, Morphology, Field tests, Soil water, Plant water potential, Crop production.

A method for calculating daily water use efficiency (WUE) from growth analysis data combined with weekly estimates of water use based on soil moisture measurements is developed for near-isogenic and normal pubescent lines of soybean. Data were collected during a two-year field study. Evapotranspiration rates were lower for dense pubescent isolines as compared with normal isolines, but differences were only significant for one cultivar. The highest WUE per unit ground area and per unit leaf area was observed in the dense pubescent Harosoy isoline which resulted from a higher crop growth rate and lower evapotranspiration. Average mid-season WUE per unit ground area and leaf area was higher for the dense Harosoy isoline than the normal isoline. No effect of pubescent density on WUE in the Clark isoline was observed. The interaction of dense pubescence illustrates the need to establish the effect of the dense pubescent gene in cultivars into which it is introduced. (Author's abstract)
W87-03000

PROCEDURE TO SELECT DROUGHT-TOLERANT SORGHUM AND MILLET GENOTYPES USING CANOPY TEMPERATURE AND VAPOR PRESSURE DEFICIT,
Arizona Univ., Tucson. Evapotranspiration Lab.
U. N. Chaudhuri, M. L. Deaton, E. T. Kanemasu, G. W. Wall, and V. Marcarian.
Agronomy Journal AGJOAT, Vol. 78, No. 3, p 490-494, May-June 1986. 7 fig, 2 tab, 11 ref.

Descriptors: *Drought resistance, *Sorghum, *Millet, *Temperature effects, *Water vapor, Regression analysis, Air temperature, Leaves, Irrigation effects.

The possibility of using canopy temperature and vapor pressure deficit to select drought-tolerant genotypes of sorghum and millet was investigated. 219 sorghum and 42 millet gentypes were planted under a line source irrigation system. Five common sorghum hybrids were used as checks. Canopy temperature was measured for seven days starting at 67 and 60 days after planting in 1983 and 1984, respectively. An overall regression of canopy minus air temperature (DT) on to the observed vapor pressure deficit (VPD) was computed using all data from each crop. This linear regression relationship was interpreted as the general relationship between VPD and DT for a crop. A linear model of individual DT on the observed VPD was also computed to predict DT at a given value of VPD for each genotype. The sensitivity of each genotype to a change in VPD was obtained by regressing the observed DT on the predicted DT from the first regression. Genotypes with coefficients greater than 1.0 were shown to be less sensitive to changes in VPD. The mean temperature of a genotype higher than the average mean temperature of all genotypes is considered as warmer. Warmer genotypes and those less sensitive to changes in VPD produced viable heads farthest from an irrigation sprinkler source. (Michael-PTT)
W87-03001

EFFECTS OF CARBON DIOXIDE ENRICHMENT AND SOIL WATER ON MAIZE,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
K. M. King, and D. H. Greer.
Agronomy Journal AGJOAT, Vol. 78, No. 3, p 515-521, May-June 1986. 2 fig, 5 tab, 22 ref.

Descriptors: *Carbon dioxide, *Enrichment, *Microclimates, *Soil water, *Corn, *Transpiration, *Water use efficiency, Plant growth, Crop yield.

The effects of increased carbon dioxide and soil water levels on the growth, yield, transpiration and water use efficiency of maize was studied. Corn plants were grown in humic silty clay loam soil in pots from emergence to maturity in controlled environment rooms at several levels of CO2 concentrations. Within each room and at a given CO2 concentration, plants were subjected to water treatments ranging from complete replacement of weekly transpiration to 75 and 50% replacement of transpiration. Differences in CO2 concentrations had no appreciable effects on the amount of dry matter produced. There were significant differences between all soil water treatments and dry matter production. Transpiration was reduced and water use efficiency increased markedly with increased CO2 concentration. Further work is need to apply the results of this controlled environment experiment to the real world. (Michael-PTT)
W87-03002

IRRIGATION INTERVAL AS A FACTOR IN SWEET CORN RESPONSE TO SALINITY,
For primary bibliographic entry see Field 3C.
W87-03003

COMPARISON OF SPRINKLER AND FLOOD IRRIGATION FOR RICE,
For primary bibliographic entry see Field 3F.
W87-03004

RESISTANCE OF PLANT ROOTS TO WATER LOSS,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
J. M. Baker, and C. H. M. van Bavel.
Agronomy Journal, AGJOAT Vol. 78, No. 4, p 641-644, July-August 1986. 6 fig, 20 ref.

Descriptors: *Roots zone, *Exudation, *Water exchange, *Water loss, *Resistance, *Bermudagrass, Permeability coefficient, Absorption, Soil water potential.

In an attempt to resolve questions about the relative magnitudes of root resistance to uptake and exudation, an experiment was conducted in which the root zone of a bermudagrass (Cynodon dactylon X Cynodon transvaalensis L. Pers.) sod was divided by a barrier in such a manner that water could move from one side to the other only through the lateral stems of the connected plants. Watering one side only created a large difference in soil water potential between the two sides. Nocturnal transfer of significant amounts of water from one side to the other, through the plant system, was observed with a gamma probe. A separately measured resistance to uptake permitted calculations of the exudation resistance which was slightly larger, but of the same order of magnitude as resistance to uptake. The study concluded that water will move from root to soil if the potential gradient is in that direction, but other factors such as hydraulic conductivity may become limiting. (Michael-PTT)
W87-03005

CLIMATIC CHANGE, WEATHER VARIABILITY, AND CORN PRODUCTION,
Iowa State Univ., Ames. Dept. of Agronomy.
L. M. Thompson.
Agronomy Journal, AGJOAT Vol. 78, No. 4, p 649-653, July-August 1986. 6 fig, 2 tab, 25 ref.

Descriptors: *Weather patterns, *Climate effects, *Corn, *Crop yield, *Model studies, Weather data collections, History, Rainfall impact, Temperature effects.

A crop/weather model was used to determine the impact of changes in climate and weather variability on corn production in five Corn Belt states between 1891 and 1983. A cooling trend from 1930 to 1972 was accompanied by increasing rainfall in July and August and by decreasing weather variability. These factors were favorable for corn yield increase. Simulated corn yields, calculated from weather data, increased from 1930 to 1972 because of improved weather for corn. After 1972, there was greater weather variability and higher intensity rainfall events. Fertilizer use increased substantially in the 1960's, but increased at a slower rate after 1972. The annual increase in corn yield under normal weather after 1972 was less than half as much as it had been between 1960 and 1972. Highest corn yields were associated with normal preseason precipitation and below normal temperatures and above normal rainfall in July and August. The period after 1970 was expected to warm, but weather variability has masked the identification of a trend. (Michael-PTT)
W87-03006

RESPONSE OF CORN TO TILLAGE AND DELAYED IRRIGATION,
North Carolina State Univ. at Raleigh. Dept. of Soil Science.
I. Porro, and D. K. Cassel.
Agronomy Journal, AGJOAT Vol. 78, No. 4, p 688-693, July-August 1986. 7 fig, 3 tab, 15 ref.

Descriptors: *Corn, *Irrigation practices, *Tillage, Plant growth, Crop yield, *Irrigation efficiency, Weather patterns, Irrigation requirements, Planting management, Cultivation, Humid areas.

Irrigation in humid regions is often delayed based on forecasting rainfall or due to labor shortages or equipment problems. The effects of tillage and delayed irrigation on corn were investigated on a Norfolk loamy sand with a tillage pan. Irrigation treatments included optimum irrigation treatment at two and four days after irrigation was needed and a nonirrigated control. Each treatment was superimposed on land that was prepared either by conventional tillage or subsoiling and bedding. Delayed irrigation during a wet growing season had little effect on corn growth. Delayed irrigation during a dry season reduced plant height, leaf area, biomass and grain yield on conventionally tilled soil, but only grain yield was reduced on subsoiled plots. With a four-day irrigation delay, grain yields were reduced by 29% for conventional tillage, but only an 11% reduction was experienced with subsoiling. Irrigation increased mean grain yield for all three delay treatments 23 and 1% for conventionally tilled and subsoiled treatments, respectively and increased to 314 and 18%, respectively, for the following year. The effects of one and two-year subsoiling yield carryovers were also determined. (Michael-PTT)
W87-03007

DRYLAND GRAIN SORGHUM WATER USE, LIGHT INTERCEPTION, AND GROWTH RESPONSE TO PLANTING GEOMETRY,
Agricultural Research Service, Bushland, TX.

Conservation and Production Lab.
J. L. Steiner.
Agronomy Journal, AGJOAT Vol. 78, No. 4, p 720-726, July-August 1986. 7 fig, 5 tab, 16 ref.

Descriptors: *Sorghum, *Water use, *Light interception, *Plant growth, *Dry farming, *Evapotranspiration, Crop yield, Planting management, Water use efficiency, Dry matter, Water loss.

Crop yields are primarily water limited under dryland production systems in semiarid regions. A study was conducted to determine whether growing season water balance could be manipulated through planting geometry. The effects of row spacing, row direction and plant population on water use, light interception and growth of grain sorghum grown on a Pullman clay loam were studied. During a dry growing season, narrow row spacing and higher population increased seasonal evapotranspiration (ET) and shifted the partitioning of ET to the vegetative period. High population resulted in high dry matter and low grain yield, while low population resulted in low dry matter and high grain yield. Row direction did not affect water use or yield. Dry matter production for a given amount of ET and light interception was higher in narrow row crops. ET was less for a given amount of light interception in narrow row crops and in the north-south row crops. Narrow row planting geometry appeared to increase the partitioning of ET to the transpiration component and could improve the efficiency of dryland cropping systems. (Michael-PTT)
W87-03008

PEROXIDE COATED SEED EMERGENCE IN WATER-SATURATED SOIL,
Wisconsin Univ.-Madison.
T. D. Langan, J. W. Pendleton, and E. S. Oplinger.
Agronomy Journal, AGJOAT Vol. 78, No. 5, p 769-772, September-October 1986. 3 tab, 19 ref.

Descriptors: *Peroxides, *Seed treatment, *Crop yield, *Anoxia, Emergence, *Grain crops, *Saturated soils, Oxygen requirements, Maize, Soybeans, Wheat, Barley, Soil water, Calcium peroxide, Zinc peroxide, Flooding.

Anoxia is a major problem in waterlogged soil, and most crop plants suffer reduced growth and yield from it. The ability of peroxide seed coatings to improve emergence in flooded soil was studied in three greenhouse experiments. Maize, soybean, wheat and barley were grown in silt loam soil in plastic trays. Soil moisture treatment included normal moisture and flooding for three days after planting. Calcium peroxide, zinc peroxide and a formulation containing calcium peroxide were applied as seed coatings. The most significant effect of the peroxides was on percent of emergence and wheat showed the most favorable results. Calcium and zinc peroxides at 25% improved wheat emergence by an average 42% in flooded treatments. Zinc peroxide at 25% improved both wheat and corn emergence with flooding. Soybean emergence was only improved slightly by zinc peroxide and was decreased by calcium peroxide. Barley emergence was not affected by peroxide. Peroxides generally had no effect under normal moisture conditions, and did not affect time to emergence, plant height and plant dry matter. Peroxide seed coatings had variable effects on plant emergence with wheat showing the most consistent positive response. (Michael-PTT)
W87-03009

DISTRIBUTION OF DRY MATTER BETWEEN SHOOTS AND ROOTS OF IRRIGATED AND NONIRRIGATED DETERMINATE SOYBEANS,
Alabama Agricultural Experiment Station, Auburn.
M. G. Huck, C. M. Peterson, G. Hoogenboom, and C. D. Busch.
Agronomy Journal, AFJOAT Vol. 78, No. 5, p 807-813, September-October 1986. 9 fig, 3 tab, 30 ref.

Descriptors: *Water stress, *Plant tissues, *Irrigation effects, *Soybeans, *Roots, Soil water, Irrigation practices, Plant growth, Dry matter, Seeds, Reproducibility, Crop yield, Flowering, Planting management.

The timing and duration of drought stress during a growing season can both limit and alter dry-matter accumulation in plants. Distribution of dry matter between roots and aboveground parts was determined by growing soybean plants for four years in a sieved sandy surface soil material that was uniformly packed to a bulk density of 1.52 Mg/cumi n soil compartments. Three replicated compartments were irrigated by trickle irrigation whenever soil water potential fell below a predetermined amount. Three additional compartments were not irrigated. Mainstem leaf area and total cumulative root growth were determined. Water stress significantly reduced total shoot weight and seed weight, but increased total root length. Irrigated plants generally had fewer roots which were shallower and more evenly distributed than those of nonirrigated plants. Both individual seed weight and total seed weight per treatment were reduced by water stress. Apparent harvest index varied, but a near linear relationship was observed between normalized final seed yield or total dry matter production and the percentage of time between flowering and harvest maturity. Aboveground dry matter and seed yield appear to be directly dependent on water availability during critical reproductive states. (Michael-PTT)
W87-03010

EFFECTS OF PATTERN AND AMOUNT OF SIMULATED RAINFALL ON SEEDLING DYNAMICS OF WEEPING LOVEGRASS AND KLEINGRASS,
Texas Tech Univ., Lubbock. Dept. of Range and Wildlife Management.
D. B. Wester, B. E. Dahl, and P. F. Cotter.
Agronomy Journal, AGJOAT Vol. 78, No. 5, p 851-855, September-October 1986. 3 fig, 4 tab, 23 ref.

Descriptors: *Simulated rainfall, *Seedlings, *Grasses, Emergence, Rainfall rate, Water requirements, Plant growth, Germination, Field tests.

Range seeding is a common improvement practice for revegetating abondoned cultivated land or following mechanical brush control. However, seeding failure is frequent because of unfavorable moisture and temperature conditions. Seedling emergence and survival of weeping lovegrass and Kleingrass was studied in response to 16 different irrigation amounts and practices at varying soil surface temperatures in dry sand. Watering treatments consisted of different sequences of wet and dry days. The pattern and amount of watering affected seedling emergence and survival. Both species required two days of water to emerge at 30 and 24 C and there was no emergence at 38 C. Seedlings that emerged soonest within a treatment tended to survive longer than later emerging seedlings. When treatment moisture was insufficient to stimulate high emergence, seeds remained viable and emerged later when additional sufficient water was available. Field trials were conducted during the second phase of this research and confirmed growth room results under natural and simulated rainfall. These results suggest that rainfall in specific patterns and amounts is important in determining seedling success. (Michael-PTT)
W87-03011

CHANGES IN SPRING WHEAT TILLERING PATTERNS IN RESPONSE TO DELAYED IRRIGATION,
Idaho Univ., Aberdeen. Research and Extension Center.
J. C. Stark, and T. S. Longley.
Agronomy Journal AGJOAT, Vol. 78, No. 5, p 892-896, September-October 1986. 5 fig, 1 tab, 15 ref.

Descriptors: *Wheat, *Cultivation, *Irrigation practices, Sand, Loam, Soil water, Plant growth, Water stress, Crop yield, Soil water potential, Sprinkler irrigation, Soil temperature, Irrigation efficiency, Planting management.

Soil water availability can have a marked effect on the vegetative development of small cereal grains. However, few studies have examined the effects of soil water deficits on the appearance patterns of specific tillers. The effects of early season irrigation timing on spring wheat tillering patterns were evaluated in field studies. Sprinkler irrigation was applied when either three, five or seven leaves were present on the main stem and subsequent irrigations were applied to provide more than 50% of available soil water for the remainder of the growing season. Main stem development was linearly related to cumulative degree-days and was not affected by irrigation timing. Tillers which developed under optimal soil moisture conditions exhibited uniform appearance patterns and reached maximum populations over relatively short degree-day intervals. Soil water deficits decreased the rate of appearance of main stem tillers and caused appearance to occur over longer intervals. Dry soil conditions also reduced development at the coleoptilar node. The appearance rate of affected tillers increased when plants were finally irrigated. In some cases, tillering stimulation was sufficient to compensate for earlier tiller losses, but periods of stress that extended into the latter part of the vegetative period often reduced maximum tiller populations. This study illustrates the importance of adequate early season water availability in developing uniform tillering patterns and high yield potential for spring wheat. (Michael-PTT)
W87-03012

HERBICIDES AND SEEDING RATE EFFECTS ON SPRINKLER-IRRIGATED RICE,
Arkansas Univ., Fayetteville. Dept. of Agronomy.
K. H. Akkari, R. E. Talbert, J. A. Ferguson, J. T. Gilmour, and K. Khodayari.
Agronomy Journal AGJOAT, Vol. 78, No. 5, p 927-929, September-October 1986. 1 fig, 2 tab, 11 ref.

Descriptors: *Seeds, *Herbicides, *Rice, *Weed control, *Sprinkler irrigation, Crop yield, Propanil, Oxadiazon, Cultivation, Planting management.

With the high demand for rice and the present constraints on land and water use, the need for sprinkler-irrigated rice production and its associated technology has increased. Such technology includes fertilization, water management, suitable cultural practices, and effective chemical weed control. Two herbicide programs and four seeding rates were tested to determine the optimum seeding rate that would maximize yields of sprinkler irrigated rice. Rice was drill seeded at various rates and propanil and a tank mixture of propanil and oxadiazon were applied at the two-leaf stage of weeds. Each herbicide treatment was followed by a 2,4,5-T treatment applied over-the-top at the onset of internode elongation of the rice stems. Both herbicide programs controlled barnyardgrass, broadleaf signalgrass, large crabgrass, common cocklebur and smooth pigweed. Propanil combined with oxadiazon controlled pitted morninggglory and prickly sida, but propanil alone did not. A significant increase in rice plant population and panicle density at the higher seeding rates was offset by a corresponding decrease in the number of seeds per panicle and rough rice yield and an increase in tillering at the lower seeding rate. Results indicate that the present recommended seeding rate for sprinkler irrigated rice should be reduced, but must be accompanied by timely and effective herbicide programs. (Michael-PTT)
W87-03013

TURFGRASS WATER USE RATES,
Texas A and M Univ., College Station.
J. B. Beard.
Grounds Maintenance, Vol. 21, No 1, p 60+, January 1986.

Descriptors: *Turf grasses, *Water use, *Evapotranspiration.

The comparative water use rates of turfgrass species are distinctly different from relative drought resistances because each is a distinctly different physiological phenomenon. Reducing the water

use rate is a strategy associated with irrigated turfs. The goal is to select turfgrasses that require the least possible supplemental water via irrigation. Comparative water use rates among 20 turfgrass species used throughout North America were delineated. The differences are substantial. The most definitive work has been done with the warm season turfgrasses, those species adapted to soil temperatures in the 80 to 95 F range and commonly grown in the southern half of the United States. As a group, the warm season turfgrasses have a lower potential evapotranspiration (ET) rate than the cool season species. The fine-leafed fescues rank medium in water use rate: Kentucky bluegrass, annual bluegrass and creeping bentgrass have exhibited very high water use rates. These cool season grasses have potential evapotranspiration rates ranging from 7.5 to 12 mm per day. The professional turf manager should be aware of the particular plant characteristics that contribute to a low water use rate. These characteristics can be used as guidelines in selecting cultivars possessing a low water use rate. Furthermore, turf breeders can use these same morphological traits to make rapid field selections of plants that are most likely to possess a low water use rate. (Alexander-PTT)
W87-03014

MANAGING WATER FOR TURFGRASS,
Iowa State Univ., Ames.
M. L. Agnew, and R. N. Carrow.
Grounds Maintenance, Vol. 21, No. 3, p 90+, March 1986.

Descriptors: *Turf grasses, *Water management, *Water shortage, Irrigation practices, Water use efficiency, Planning, Evaporation control.

While the cost of irrigating high quality turfgrass areas is increasing, water for irrigation is becoming more scarce. The economic and recreational benefits of irrigating turfgrass during periods of water shortage are reviewed and the importance of water use contingency planning by turfgrass managers is emphasized. Turfgrass irrigation practices that control evaporation losses are also discussed. (Michael-PTT)
W87-03016

CONTROLLING TURFGRASS WATER USE RATES,
Texas A and M Univ., College Station.
J. B. Beard.
Grounds Maintenance, Vol. 21, No. 4, p 80+, April 1986.

Descriptors: *Turf grasses, *Water use, *Cultivation, Nitrogen, Water conservation, Cutting management.

Cultural influences such as nitrogen nutritional levels and cutting height are important factors in turfgrass water use conservation. Those turfgrasses that have a low nitrogen requirement tend to have a water use rate that is influenced more by changes in cutting height than by nitrogen fertility. Turfgrasses that have a relatively high nitrogen requirement have water use rates that are more affected by changes in the nitrogen nutritional level than by cutting the height. Although significant water conservation can be achieved by selecting the appropriate water-conserving turfgrass species, it is equally important to select the appropriate cultural practices to maximize the water conservation characteristics of that particular species. Of particular significance are the nitrogen nutritional level and the cutting height. (Alexander-PTT)
W87-03017

DROUGHT AVOIDANCE IN TALL FESCUE,
Arizona Univ., Tucson.
D. M. Kopec.
Grounds Maintenance, Vol. 21, No. 5, p 30-32, May 1986.

Descriptors: *Drought resistance, *Turf grasses, *Forages, Soil water.

Drought resistance is the plant's ability to carry on metabolic processes under low water levels inside the plant. When a plant's water content decreases, photosynthesis and transpiration can be greatly reduced. This often reduces plant growth or turf performance, or both. Field experiments were conducted to demonstrate the ability of tall fescue turfgrass clones to withstand drought through its superior soil moisture extraction ability. Most tall fescue clones that had large root systems took up more water, thereby avoiding wilt. Intermating of plants with minimal wilt and high soil moisture extraction plus testing of their offspring is a positive step toward improving the summer performance of mowed tall tescue turf. (Michael-PTT)
W87-03019

POTASSIUM UTILIZATION AND FLUXES IN WILD SALT-TOLERANT RELATIVES OF THE CULTIVATED TOMATO,
Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Biology.
E. Taleisnik-Gertel, and M. Tal.
Physiologia Plantarum PHPLAI, Vol. 67, No. 3, p 415-420, July 1986. 2 fig, 5 tab, 28 ref.

Descriptors: *Tomato, *Wild tomato, *Salt tolerance, *Potassium, Plasma membranes, Membrane permeability, Nutrients, Ions, Plant growth, Roots, Cultivation, Accumulation, Tonoplast permeability, Plant physiology.

The growth of the wild tomato species Lycopersicon peruvianum (L.) Mill. and L. pennellii (Correll) D'Arcy, was compared with that of the cultivated tomato, L. esculentum cv. VE 234, under conditions of reduced K(+) supply. Growth was impaired less in the wild than in the cultivated species. The higher efficiency of K(+) utilization in the wild species was not associated with more efficient K(+) uptake from the medium. The rate of K(+) uptake by whole plants was similar in the three species, but the rate of uptake of detached root tips was lower in the wild species. The permeability of the plasma membrane to K(+) was apparently similar in root tips of the three species, but the tonoplast permeability was much lower in the wild than in the cultivated species. (Author's abstract)
W87-03055

EFFECT OF ROOTSTOCK ON APPLE (MALUS DOMESTICA) TREE WATER RELATIONS,
Maine Univ. at Orono. Dept. of Plant and Soil Sciences.
W. C. Olien, and A. N. Lakso.
Physiologia Plantarum PHPLAI, Vol. 67, No. 3, p 421-430, July 1986. 2 fig, 8 tab, 29 ref.

Descriptors: *Rootstocks, *Apples, *Capacitance, *Water potentials, Orchards, Plant physiology, Transpiration, Stomatal conductance, Temperature, Light, Water storage capacity, Tree size, Permeability coefficient, Xylem water transport.

The effects of rootstock on mid-season water relations, under orchard conditions of non-limiting soil moisture, were determined for bearing 'Empire' apple trees (Malus domestica Borkh) on the clonal rootstocks M9, M26, M7, MM106, and MM104 (most to least dwarfing in their sixth and seventh growing seasons. Stem water potentials (SWP) of trees on M9 and M26 were more negative at midday, under warm, sunny conditons, than were those of the trees on the other three rootstocks. However, change in SWP per change in stem distance through the canopy (water potential gradient) did not vary among the rootstocks at midday. There was not rootstock effect on diurnal variation in transpiration and stomatal conductance. Differences in water storage capacitance relative to tree size were determined in a separate study but did not account for the differences observed in SWP. Calculated hydraulic conductivities of xylem water transport suggest that rootstocks differ in their ability to conduct water to the scion, but hydraulic conductivity of the scion was not affected by rootstock. Rootstock differences in hydraulic conductivity were not accounted for by differences in tree size. (Author's abstract)
W87-03056

EFFECTS OF SEAWATER ON AMINO ACIDS AND MINERAL IONS COMPOSITION IN SALICORNIA BRACHIATA ROXB,
Bhavnagar Univ. (India). Dept. of Life Sciences.
For primary bibliographic entry see Field 3C.
W87-03093

RESPONSE TO WATERLOGGING AND DIFFERING SENSITIVITY TO DIVALENT IRON AND MANGANESE IN CLONES OF DACTYLIS GLOMERATA L. DERIVED FROM WELL-DRAINED AND POORLY-DRAINED SOILS,
University Coll., Cardiff (Wales). Dept. of Plant Science.
For primary bibliographic entry see Field 5C.
W87-03095

RELATIONSHIPS BETWEEN GROWTH AND MEASURED WEATHER FACTORS AMONG CONTRASTING VARIETIES OF LOLIUM, DACTYLIS AND FESTUCA SPECIES,
Welsh Plant Breeding Station, Aberystwyth.
I. B. Norris.
Grass and Forage Science GFSCDW, Vol. 40, No. 2, p 151-159, June 1985. 2 fig, 7 tab, 28 ref.

Descriptors: *Ryegrass, *Tall fescue, *Cocksfoot, *Plant growth, *Weather, *Irrigation, *Temperature effects, Seasonal distribution, Leaf extension rate, Soil water deficit, Drought, Plant water relations, Solar radiation, Plant physiology, Cultivation, Irrigation.

Italian, perennial, hybrid ryegrass, tall fescue, and cocksfoot were used to determine the influence of weather upon grass growth throughout the spring and summer months of 1975 and 1976. Crop growth rate, leaf extension rate, leaf appearance rate, tillering, and weather conditions were recorded. Natural (control), covered, and irrigated treatments were applied. In spring, crop growth rates were correlated with solar radiation and temperature, but growth rates were highest with high levels of insolation. Leaf extension rate was associated with temperature during spring. During summer, however, the association between temperature and leaf extension became confused as soil water deficit increased. Leaf extension rate in the tall fescue variety S170 was the slowest of all for a given temperature. In 1975 leaf growth was very sensitive to temperature; the rate of leaf appearance increased as the temperature increased. In 1976, water deficit reduced crop growth rate in spring and was the major factor influencing crop growth rates in all varieties during summer. Leaf extension and leaf appearance rates were both reduced by increasing soil water deficit. The ryegrasses appeared most sensitive to drought and poor recovery growth was found in the Italian Lolium RvP and the Lolium hybrid Snowdon. (Author's abstract)
W87-03100

MICROCLIMATE OF AN UPLAND GRASSLAND,
West of Scotland Agricultural Coll., Auchincruive.
R. K. M. Hay.
Grass and Forage Science GFSCDW, Vol. 40, No. 2, p 201-212, June 1985. 7 fig, 4 tab, 37 ref.

Descriptors: *Microclimates, *Uplands, *Grasslands, *Air temperature, *Soil temperature, *Solar radiation, *Wind velocity, *Soil water, *Dry matter yield, Plant growth, Plant physiology, United Kingdom, Seasonal distribution.

Continuous hourly measurements of air and soil temperatures, irradiance and wind velocity, and less frequent measurements of soil water status and dry matter (DM) yield were recorded over two growing seasons and the intervening winter 1978-79 for an enclosed upland grassland in Cumbria (United Kingdom), with the aim of establishing realistic combinations of enviromental factors for the design of experiments under controlled conditions. Important features of the microclimate included high diurnal and day-to-day variation in environmental temperature, relatively high winter

soil temperatures, variation between years in the influence of altitude upon irradiance, low wind velocity throughout the year at plant height and the loss of DM yield in the early summer of 1978 due to severe drought. The records indicate that in growth-cabinet or greenhouse experiments associated with breeding or selection of cultivars for earlier DM production in spring, it is important to combine low temperatures (< or = 10 C) with realistic levels of irradiance (> or = 200 W/sq m), and daylength (12.5-15 hr). (Author's abstract)
W87-03101

IRRIGATION SCHEDULING EFFECTS ON CONTAINER MEDIA AND CANOPY TEMPERATURES AND GROWTH OF 'HERSHEY'S RED' AZALEA,
Auburn Univ., AL. Dept. of Horticulture.
For primary bibliographic entry see Field 3F.
W87-03103

EFFECT OF SHORT-TERM WATER STRESS ON LEAF GAS EXCHANGE PROCESSES AND PLANT WATER POTENTIAL IN SCHEFFLERA,
Antwerp Univ., Wilrijk (Belgium). Dept. of Biology.
P. Lorenzo-Minguez, R. Ceulemans, R. Gabriels, I. Impens, and O. Verdonck.
Hortscience HJHSAR, Vol. 20, No. 5, p 932-934, October 1985. 2 fig, 1 tab, 11 ref.

Descriptors: *Water stress, *Growth chambers, *Leaf gas exchange, *Plant water potential, *Schefflera arboricola, Plant physiology, Carbon dioxide, Transpiration, Stomatal conductance, Temperature, Photosynthesis, Light, Humidity, Soil moisture deficit.

Situations of increasing water stress were imposed on Schefflera arboricola Hayata 'Compacta' for up to 7 days under controlled growth chamber conditions. Net CO2 exchange and transpiration rates, stomatal conductance to water vapor, and xylem water potential were measured at constant temperature, photosynthetic photon flux density, and atmospheric humidity. A strong relationship was found for transpiration and CO2 exchange process. When the water content of the substrate decreased as a result of transpiration and soil surface evaporation, both transpiration and CO2 exchange rates decreased drastically. Xylem water potential remained fairly constant during this soil moisture deficit. Following the dry cycle efficient and fast recovery of the plants was observed. (Author's abstract)
W87-03104

GROWTH AND NUTRITIONAL STATUS OF PETUNIA AND TOMATO SEEDLINGS WITH ACIDIFIED IRRIGATION WATER,
Purdue Univ., Lafayette, IN. Dept. of Horticulture.
For primary bibliographic entry see Field 5C.
W87-03105

EFFECT OF WOVEN PLASTIC MULCH, HERBICIDES, GRASS SOD, AND NITROGEN ON 'FOCH' GRAPES UNDER IRRIGATION,
Department of Agriculture, Summerland (British Columbia). Research Station.
For primary bibliographic entry see Field 3F.
W87-03106

NURSERY IRRIGATION-SYRINGE SYSTEM THAT MONITORS ENVIRONMENTAL PARAMETERS,
Texas A and M Univ., College Station. Dept. of Physics.
For primary bibliographic entry see Field 7C.
W87-03107

MUSKMELON GROWTH, YIELD, AND NUTRITION AS INFLUENCED BY PLANTING METHOD AND TRICKLE IRRIGATION,
Agricultural Research Service, Charleston, S.C. Vegetable Lab.
For primary bibliographic entry see Field 3F.
W87-03108

NITROGEN SOURCE AND APPLICATION TIMING FOR TRICKLE IRRIGATED STRAWBERRIES,
Agricultural Research and Education Center, Lake Alfred, FL.
For primary bibliographic entry see Field 3F.
W87-03109

SEASONAL RESPONSE OF 'ANJOU' PEAR TREES TO DIFFERENT IRRIGATION REGIMES. I. SOIL MOISTURE, WATER RELATIONS, TREE AND FRUIT GROWTH,
Washington State Univ., Wenatchee. Tree Fruit Research Center.
For primary bibliographic entry see Field 3F.
W87-03110

SEASONAL RESPONSE OF 'ANJOU' PEAR TREES TO DIFFERENT IRRIGATION REGIMES. II. MINERAL COMPOSITION OF FRUIT AND LEAVES, FRUIT DISORDERS, AND FRUIT SET,
Washington State Univ., Wenatchee. Tree Fruit Research Center.
For primary bibliographic entry see Field 3F.
W87-03111

SEASONAL GROWTH AND COMPOSITION AND ACCUMULATION OF N-P-K IN DRYLAND AND IRRIGATED PUMPKINS,
Illinois Univ. at Urbana-Champaign. Dept. of Horticulture.
J. M. Swiader.
Journal of Plant Nutrition JPNUDS, Vol. 8, No. 10, p 909-919, October 1985. 4 tab, 11 ref.

Descriptors: *Pumpkins, *Crop yield, *Seasonal variation, *Nutrient accumulation, *Dryland culture, *Irrigated culture, *Nitrogen, *Phosporus, *Potassium, *Plant water relations, *Plant nutrition, Plant growth, Plant development, Fruit crops.

Growth and N-P-K uptake in pumpkin (Cucurbita moschata Poir.) cv. 'Libby-Select' were studied in dryland and irrigated culture. In both moisture regimes, maximum rates of dry matter accumulation occurred between the early and mid-fruiting developmental stages. Higher total dry matter production with irrigated other than dryland culture was primarily associated with increased shoot growth. Concentrations of N, P, and K in foliage generally decreased as pumpkin age increased. Irrigated pumpkins in conjunction with higher total vegetative dry matter accumulated more N, P, and K than dryland pumpkins. Through the stage of early fruit development, N, P, and K accumulation was primarily in leaves and vines and by the late growth stages was almost entirely in the fruit. Total N, P, and K uptake at late fruiting was estimated at 219, 32, and 228 kg/ha in irrigated pumpkins and 180, 21, and 177 kg/ha in dryland pumpkins. Approximately 58% of the N, 52% of the K, and 68% of the P accumulated by late-fruiting was absorbed by the plant after early-fruiting stage in both moisture regimes. K redistribution from vegetative tissues during late fruit development decreased foliar K contents 32% in dryland pumpkins and 21% in irrigated pumpkins. (Author's abstract)
W87-03150

AMMONIUM (15N) METABOLISM IN COTTON UNDER SALT STRESS,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 5C.
W87-03151

BORON TOLERANCE AND ACCUMULATION IN THE DUCKWEED, LEMNA MINOR,
Delaware Univ., Newark. Dept. of Plant Science.
For primary bibliographic entry see Field 5C.
W87-03152

MICRONUTRIENT TOLERANCE AND ACCUMULATION IN THE DUCKWEED, LEMNA,
Delaware Univ., Newark. Dept. of Plant Science.
For primary bibliographic entry see Field 5C.
W87-03153

RESPONSES OF LETTUCE TO SALINITY. I. EFFECTS OF NACL AND NA2SO4 ON GROWTH,
California Univ., Davis. Dept. of Vegetable Crops.
For primary bibliographic entry see Field 5C.
W87-03154

SALT RESPONSES OF LETTUCE TO SALINITY. II. EFFECT OF CALCIUM ON GROWTH AND MINERAL STATUS,
California Univ., Davis. Dept. of Vegetable Crops.
For primary bibliographic entry see Field 5C.
W87-03155

CONTRASTING RESPONSE TO SALT STRESS OF TWO SALINITY TOLERANT CREEPING BENTGRASS CLONES,
California Univ., Davis. Dept. of Environmental Horticulture.
For primary bibliographic entry see Field 5C.
W87-03156

WATER DEFICIT DURING PANICLE DEVELOPMENT IN PEARL MILLET: YIELD COMPENSATION BY TILLERS,
International Crops Research Inst. for the Semi-Arid Tropics, Patancheru (India).
V. Mahalakshmi, and F. R. Bidinger.
The Journal of Agricultural Science JASIAB, Vol. 106, No. 1, p 113-119, February 1986. 1 fig, 4 tab, 16 ref.

Descriptors: *Pearl millet, *Grain yield, *Tillers, *Irrigation, *Plant growth, *Water stress, Irrigation, Plant water potential, Plant physiology, Shoots, Panicle initiation, Flowering, Compensatory mechanisms, Plant pathology.

The potential extent of compensation in pearl millet grain yield components by tillers was investigated by removing the main shoot at panicle initiation (PI) and flowering stages, respectively, for both irrigated and water-stressed plants. Grain yield loss by removal of the main shoot of plants at PI was compensated fully by tiller grain yield in both the irrigated and water-stressed plants. The compensation was, however, only partial when the main shoot was removed at flowering. The compensation for the grain yield loss in the main shoot due either to water stress or removal was through an increase in the number of grains on the tillers. This increase was due to an increase in the number of productive tillers and an increase in the number of grains per panicle in the case of main shoot removal. This compensatory mechanism by tillers plays an important role in overcoming the effects of pre-flowering water stress damage to the main shoot. (Author's abstract)
W87-03157

DEPARTMENT OF AGRICULTURE, BELFAST (N. IRELAND). AGRICULTURAL AND FOOD CHEMISTRY RESEARCH DIV.
Agriculture and Food Science Centre, Belfast (Northern Ireland). Agricultural and Food Chemistry Research Div.
For primary bibliographic entry see Field 3F.
W87-03159

COMPACTION AND TILLAGE DEPTH COMBINATIONS FOR WATER MANAGEMENT AND RICE PRODUCTION IN LOW-RETENTIVE PERMEABLE SOILS,
Indian Inst. of Tech., Kharagpur. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 3F.
W87-03163

EFFECTS OF TILLAGE METHODS AND WATER REGIMES ON SOIL PROPERTIES AND YIELD OF LOWLAND RICE FROM A SANDY LOAM SOIL IN SOUTHWEST NIGERIA,
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
L. T. Ogunremi, R. Lal, and O. Babalola.
Soil and Tillage Research SOTDR5, Vol. 6, No. 3, p 223-234, February 1986. 6 tab, 30 ref.

Descriptors: *Tillage, *Soil compaction, *Soil properties, *Rice, Puddling, No-tillage management, Crop yield, Consecutive cropping, Flooding, Rain-fed agriculture, Potassium, Calcium, Magnesium, Phosphorus, Sodium, Manganese, Iron, Zinc, Dry matter, Field tests, Nutrients.

Field experiments were conducted on a sandy loam soil (Aeric Tropaquent) to assess the effects of compaction, puddling, and no-till systems on soil physical properties and on rice growth and yield with and without supplementary irrigation. Soil compaction decreased macro- and micro-pores more than puddling or no-till treatments. The equilibrium infiltration rates were 0.12, 0.15, and 1.65 micron/sec in compacted, ploughed, and no-till treatments, respectively. The saturated hydraulic conductivity, void ratio, and moisture content at -0.01 and -1.5 mPa water potential followed a similar trend. The mean weight diameters were 2.40, 2.36, and 2.09 mm for compacted, puddled, and no-till treatments, respectively. The mean grain yields for four consecutive crops were 6.4, 5.1, and 4.9 megagram/ha for the three treatments, respectively. Compared with both puddling and no-till treatments, soil compaction resulted in yield increases of about 20% under the rain-fed regime and 34-40% in the flooded moisture regime. There was about 26% increase in grain yield by continuous flooding compared to the rain-fed treatments, with the rice producing greater dry matter and biological yields due to a higher uptake of P, Ca, Mg, K, Na, Mn, Fe, and Zn. (Author's abstract)
W87-03164

EFFECT OF DEEP TILLAGE AND CONTROLLED TRAFFIC ON ROOT GROWTH, WATER-USE EFFICIENCY AND YIELD OF IRRIGATED MAIZE AND WHEAT,
Orange Free State Univ., Bloemfontein (South Africa). Dept. of Soil Science.
For primary bibliographic entry see Field 3F.
W87-03165

EFFECT OF TILLAGE AND MULCHING ON SOIL ENVIRONMENT AND COWPEA SEEDLING GROWTH UNDER ARID CONDITIONS,
Central Arid Zone Research Inst., Jodhpur (India). Div. of Soil-Water-Plant Relationship Studies.
For primary bibliographic entry see Field 3F.
W87-03166

RESPONSE OF CONSERVATION TILLAGE SORGHUM TO GROWING SEASON PRECIPITATION,
Agricultural Research Service, Bushland, TX. Conservation and Production Lab.
For primary bibliographic entry see Field 3F.
W87-03167

EFFECTS OF IN-ROW AND INTERROW SUBSOILING AND TIME OF NITROGEN APPLICATION ON GROWTH, STOMATAL CONDUCTANCE AND YIELD OF STRIP-TILLED CORN,
Alabama Agricultural Experiment Station, Auburn.
For primary bibliographic entry see Field 3F.
W87-03170

EFFECTS OF SULPHIDE ON SURVIVAL OF AERO-AQUATIC AND AQUATIC HYPHOMYCETES,
Exeter Univ. (England). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W87-03174

WATER OR SALT STRESS INCREASES INFECTIVITY OF ERYSIPHE PISI CONIDIA TAKEN FROM STRESSED PLANTS,
Lancaster Univ., Bailrigg (England). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W87-03175

TRIADIMEFON PROTECTS BEAN PLANTS FROM WATER STRESS THROUGH ITS EFFECTS ON ABSCISIC ACID,
Guelph Univ. (Ontario). Dept. of Environmental Biology.
N. K. Asare-Boamah, G. Hofstra, R. A. Fletcher, and E. B. Dumbroff.
Plant and Cell Physiology PCPHA, Vol. 27, No. 3, p 383-390, April 1986. 9 fig, 2 tab, 25 ref.

Descriptors: *Beans, *Water stress, *Moisture stress, *Abscisic acid, *Triadimefon, *Drought resistance, Fungicides, Plant physiology, Plant tissues, Chlorophyll a, Carotenoids, Leaves, Drought.

Triadimefon is a fungicide that has plant growth regulating properties. In beans (Phaseolus vulgaris L.) it significantly reduced shoot weight, shoot length, and leaf area, and roots appeared whiter and thicker in the treated plants. Chlorophyll and carotenoid levels were increased in the leaves, but triadimefon did not affect protein levels in either leaves or roots. Triadimefon reduced transpiration, and protected the plants from drought. It increased leaf diffusive resistance indicating a partial closure of the stomates; treated plants maintained their water potentials while those of the controls declined. Osmotic potentials of both treated and control leaves fell, but values in the controls were significantly lower than those from the treated plants. Three days after treatment with triadimefon, in both water stressed and non-stressed plants, the abscisic acid levels in the leaves of the treated plants were more than twice the levels of the controls. It appears therefore, that the protection conveyed by triadimefon during water stress is mediated at least partially, via its effects on abscisic acid levels in treated tissue. (Author's abstract)
W87-03202

RATES OF MINERAL ELEMENT LEACHING FROM LEAVES OF NINE PLANT SPECIES FROM A SOUTHERN APPALACHIAN FOREST SUCCESSION SUBJECTED TO SIMULATED ACID RAIN,
Georgia Univ., Athens. Dept. of Botany.
For primary bibliographic entry see Field 5C.
W87-03206

ACCUMULATION AND TURNOVER OF ABSCISIC ACID IN OSMOTICALLY STRESSED COTTON LEAF TISSUE IN RELATION TO TEMPERATURE,
Agricultural Research Service, Phoeniz, AZ. Western Cotton Research Lab.
J. W. Radin, and D. L. Hendrix.
Plant Science PLSCE4, Vol. 45, No. 1, p 37-42, 1986. 3 fig, 1 tab, 19 ref.

Descriptors: *Abscisic acid, *Moisture stress, *Osmotic pressure, *Water stress, *Cotton, *Temperature, Leaves, Leakage, Plant physiology, Radioactive tracers, Polyethylene glycol.

Leaf discs of cotton (Gossypium hirsutum L. cv. Deltapine 70) were osmotically stressed by floating them on solutions of polyethylene glycol 8000. The tissue produced copious amounts of abscisic acid (ABA) when stressed. Accumulation of ABA depended strongly upon temperature during the incubation, displaying a maximum at 20 C. At 35 C, the amount of ABA accumulated after 24-hr was 45-80% less than at 20 C. Temperature did not affect leakage of ABA into the medium. Turnover rate of (14-C)ABA was more than 3 times greater at 35 C than at 20 C. This rapid turnover at 35 C could account for the decreased ABA accumulation. Three 14-C containing metabolites of ABA, were extracted from the tissue. At 20C, two of these accumulated and retained substantial 14-C over 16 hr. At 35 C, though, the 14-C in one of these compounds was almost completely lost during the last 8 hr of the incubation. Although the metabolites are not identified, the results show some specific effects of temperature on ABA metabolism. The strong effect of temperature on ABA accumulation may contribute to patterns of ABA-dependent processes (such as stomatal closure) during water stress. (Author's abstract)
W87-03216

FEASIBILITY OF USING MYCORRHIZAL FUNGI FOR ENHANCEMENT OF PLANT ESTABLISHMENT ON DREDGED MATERIAL DISPOSAL SITES: A LITERATURE REVIEW,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 3D.
W87-03316

2J. Erosion and Sedimentation

EROSION OF UNCONSOLIDATED GRAVEL BEDS,
Windsor Univ. (Ontario). Dept. of Civil Engineering.
S. P. Chee, and E. M. Yuen.
Canadian Journal of Civil Engineering CJCEB, Vol. 12, No. 3, p 559-566, September 1985. 6 fig, 27 ref.

Descriptors: *Erosion, *Stream degradation, *Gravel beds, *River beds, Scour depth, Hydraulic design, Engineering, Water jets, Scour holes.

In river bed degradation, the vertical dimension of the deepest part of the scour hole is an important parameter describing the numerical value of other important erosion parameters. Basic to the understanding of the mechanism of local scour is the concept of initiation of motion. This study uses this concept to derive generalized relations that link the incipient motion condition at the deepest point of the scour-hole with the numerical value of the scoured depth. In addition, only hydraulic variables are included in the analysis in order to make the results useful to the practicing engineer. (Author's abstract)
W87-02673

FORECASTING SEDIMENT DISTRIBUTION IN RESERVOIRS DURING UNSTABLE CONDITIONS,
Rand Afrikaans Univ., Johannesburg (South Africa). Faculty of Engineering.
G. W. Annandale.
Journal of Hydrology JHYDA7, Vol. 80, No. 3/4, p 361-370, October 1985. 6 fig, 3 tab, 9 ref.

Descriptors: *Sediment distribution, *Reservoir silting, *Stream power, *Sediments, Reservoirs, Unstable conditions, Catchments, Sediment slope, South Africa, Stream discharge, Flow velocity.

A method for rapid estimation of slopes of deposited sediment in reservoirs during unstable conditions is presented. It is argued that the slope of deposited sediment must be a function of the sediment-carring capacity of a current flowing through a reservoir. Two South African reservoirs were studied. A semi-empirical graph was prepared which relates sediment slope to a factor representing stream power in reservoirs. Interpretation of the stronger currents indicates that low stream power is correlated to steep sediments slopes and vice versa. The reason for this is that reservoirs with low average values of stream power will deposit more sediment at the inflow to the reservoir, whereas sediment will be transported closer to the dam in reservoirs with high average values of stream power. The weaker currents will therefore result in sediment deposits with small slopes and the stronger currents in sediment deposits with large slopes. (Kane-PTT)
W87-02680

TRANSPORT OF GRAVEL BY FLOWS UP TO 500 CU M/S, OHAU RIVER, OTAGO, NEW ZEALAND,

Ministry of Works and Development, Christchurch (New Zealand). Hydrology Centre.
S. M. Thompson.
Journal of Hydraulic Research JHYRAF, Vol. 23, No. 3, p 285-303, 1985. 13 fig, 2 tab, 10 ref.

Descriptors: *Gravel, *Sediment transport, *River flow, *Ohau River, New Zealand, *Sedimentation, Rivers, Deltas, Flow measurement, Bed load, Mathematical studies, Channels, Flow rates, Jet zones.

Detailed measurements of velocity, and of sediment transport inferred from delta build up, are used to calibrate a bed-load formula for a river scoured by flows up to 500 cu m/s to form a delta. According to this calibration, jet zones occupying less than 6% of the channel area convey approximately half the load. The resulting ratings for bedload are presented in terms of sediment loads, velocity, and flow. The mean discharges of gravel and water over a period of approximately two years were 0.0165 and 218 cu m/s, respectively; a 'concentration' of 204 g/cu m. The median sediment diameter was 0.02 m and the channel slope 0.006. An attempt to reconcile field and laboratory data using the conventional scaling of transport with shear stress failed, but scaling with velocity was successful. (Author's abstract)
W87-02773

SEASONAL SEDIMENT YIELD TO MARK TWAIN LAKE, MISSOURI,
Soil Conservation Service, Columbia, MO.
V. L. Finney.
Bulletin of the Association of Engineering Geologists, Vol. 23, No. 3, p 333-338, August 1986. 4 fig, 3 tab, 11 ref.

Descriptors: *Sediment yield, *Seasonal variation, *Mark Twain Lake, Missouri, *Sedimentation, *Mathematical studies, Gaging stations, Sediments, Suspended sediments, Regression analysis, Streamflow, Flow, Sediment load, Clays, Sand, Silt.

Average seasonal suspended sediment yields to a U.S. Geological Survey gaging station on the Salt River near Monroe City, Missouri were calculated by deriving linear regressions between suspended sediment concentration and streamflows, computing sediment load, and using mean weighted streamflows to compute average seasonal suspended sediment loads. The average calculated seasonal suspended sediment loads are as follows: spring, 881,000 tons; summer, 117,000 tons; fall, 82,000 tons; and winter, 135,000 tons. Seasonal displays are further subdivided into the major grain size fractions (clay, silt, and sand). (Author's abstract)
W87-02789

FLUVIAL PROCESSES AND MORPHOLOGICAL THRESHOLDS IN INCISED CHANNEL RESTORATION,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
M. D. Harvey, and C. C. Watson.
Water Resources Bulletin WARBAQ, Vol. 22, No. 3, p 359-368, June 1986. 2 fig, 2 tab, 73 ref.

Descriptors: *Fluvial processes, *Channel erosion, *Channel morphology, *Channel rehabilitation, *Bed degradation, *Channel evolution models, *Morphological thresholds, *Incised channel, Bank stability, Thresholds, Discharge, Grade, Degraded channels, Erosion.

Incised channels are those in which an imbalance between sediment transport capacity and sediment supply has led to degradation of their beds. This is a frequent response to stream channelization, changes in land use, or lowering of base level. If the degradation causes a critical bank-height threshold to be exceeded, then bank failure and channel widening follow. Interdependent adjustments of channel slope and cross-sectional area occur until a new state of dynamic equilibrium with the imposed discharge and sediment load is attained. These geomorphic adjustments can be described and quantified by using location-for-time substitution and a model of channel evolution can be formulated. Three approaches to rehabilitation of the degraded channels are possible; geomorphic, engineering and rational. The rational approach, which integrates elements of both engineering and geomorphic approaches, is based on the channel evolution model, and it generally involves control of grade, control of discharge, or a combination of both. (Author's abstract)
W87-02930

MORPHOLOGICAL FEATURES OF SMALL STREAMS: SIGNIFICANCE AND FUNCTION,
Oregon State Univ., Corvallis. Dept. of Forest Engineering.
For primary bibliographic entry see Field 4A.
W87-02931

ARSENIC DISTRIBUTIONS IN POREWATERS AND SEDIMENTS OF PUGET SOUND, LAKE WASHINGTON, THE WASHINGTON COAST AND SAANICH INLET, B.C.,
Washington Univ., Seattle. School of Oceanography.
For primary bibliographic entry see Field 5B.
W87-03133

DISSOLVED ORGANIC MATTER IN ANOXIC PORE WATERS FROM MANGROVE LAKE, BERMUDA,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 5A.
W87-03136

PARTITIONING OF 7 BERYLLIUM IN FRESH WATER,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
For primary bibliographic entry see Field 5A.
W87-03142

COMPACTION, HYDROLOGICAL PROCESSES AND SOIL EROSION ON LOAMY SANDS IN EAST SHROPSHIRE, ENGLAND,
Polytechnic Wolverhampton (England).
M. A. Fullen.
Soil and Tillage Research SOTRD5, Vol. 6, No. 1, p 17-29, September 1985. 8 fig, 3 tab, 27 ref.

Descriptors: *Hydrology, *Rainfall-runoff relationships, *Soil compaction, *Soil erosion, *Agricultural machinery, *East Shropshire, England, Loamy sands, Bulk density, Soil erodibility, Infiltration rates, Runoff, Topsoil losses, Field tests.

Field investigations on loamy sands in east Shropshire show that compaction by agricultural machinery increases soil bulk density and soil erodibility, and decreases infiltration rates. Structural and hydrologic changes, in combination with runoff concentration in cultivation lines, can contribute to serious erosion of arable soils. Compacted soils also are more responsive to rainfall, and evidence is presented that intensities as low as approximately 1 mm/hr can be erosive. Evidence suggests that compacted subsoils impede infiltration and so contribute to surface runoff and serious topsoil erosion. (Author's abstract)
W87-03160

GROUNDWATER SEEPAGE VECTORS AND THE POTENTIAL FOR HILLSLOPE FAILURE AND DEBRIS FLOW MOBILIZATION,
Cascades Volcano Observatory, Vancouver, WA.
For primary bibliographic entry see Field 2F.
W87-03193

HISTORIC TRENDS IN THE SEDIMENT FLOW REGIME OF THE MISSISSIPPI RIVER,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
M. P. Keown, E. A. Dardeau, and E. M. Causey.
Water Resources Research WRERAQ, Vol. 22, No. 11, p 1555-1564, October 1986. 4 fig, 7 tab, 12 ref.

Descriptors: *Sediment transport, *Suspended load, *Mississippi River, *History, *Sediment discharge, Annual variation, Arkansas River, Atchafalaya River, Louisiana, Sediment-carrying capacity, Sediment discharge, Silt, Sand.

Prior to cultural development in the Mississippi River Basin, the main stem was a heavy sediment carrier due to the character of the climate and soils in the basin. The placement of flood control structures and other channel improvement features, and the implementation of improved land management practices, have significantly changed the suspended-sediment flow regime of the main stem. The estimated annual sediment yield of the basin is 900 million (817 million metric) tons. That portion of the yield passing into the Gulf of Mexico, as monitored at suspended-sediment sample collection stations near the mouths of the Mississippi and Atchafalaya rivers, totaled 434 million (394 million metric) tons prior to 1963. However, this value has since declined to 225 million (204 million metric) tons. Long-term trends in the bed material gradation of the Lower Mississippi, downstream from the mouth of the Arkansas River, have remained relatively constant. Both from Donaldsonville, Lousiana, downstream to the Head of Passes, there has been a pronounced shift from the sand to silt fraction. (Author's abstract)
W87-03195

LATE QUATERNARY ALLUVIAL STRATIGRAPHY OF WHITEWATER DRAW, ARIZONA: IMPLICATIONS FOR REGIONAL CORRELATION OF FLUVIAL DEPOSITS IN THE AMERICAN SOUTHWEST,
For primary bibliographic entry see Field 8E.
W87-03209

CRATER LAKE, OREGON: A RESTRICTED BASIN WITH BASE-OF-SLOPE APRONS OF NONCHANNELIZED TURBIDITES,
Geological Survey, Menlo Park, CA.
C. H. Nelson, A. W. Meyer, D. Thor, and M. Larsen.
Geology GLGYB, Vol. 14, No. 3, p 238-241, March 1986. 5 fig, 13 ref.

Descriptors: *Crater Lake, *Sedimentation, *Stratigraphy, *Turbidites, *Oregon, *Lake basins, Sedimentary basins, Sediments, Basins, Deposition, Gravity flow.

The basin floor of Crater Lake (10-km diameter, 600-m depth) is covered by up to 75 m of sediment-gravity-flow deposits interbedded with mud. In the upper units (8-m thick), sand and gravel layers with numerous wedging, strong seismic reflectors characterize the base-of-slope aprons at the basin margin. These layers evolve to turbidites of mainly thin, fine-grained, basin-plain type, characterized by numerous flat and weak seismic reflectors in the central basin floor. Many individual debris-chute sources funnel sediment to base-of-slope aprons: there, coarse-grained parts of the sediment-gravity flows deposit nonchannelized beds attributed to the F, A, B turbidite facies. While traversing the base-of-slope aprons, flows evolve to sheet-flow turbidity currents that deposit D-facies beds over the central basin floor. These processes and patterns of deposition characterize small siliciclastic basins without channelized submarine fans and are common in carbonate basins of all sizes. (Author's abstract)
W87-03220

STUDY ON CHEMICAL BEHAVIOR BETWEEN SEDIMENT AND UPPER WATER,
Yamaguchi Univ. (Japan). Dept. of Civil Engineering.
H. Nakanishi, M. Ukita, and Y. Kawai.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 63-84, 17 fig, 3 tab, 17 ref.

Descriptors: *Chemical analysis, *Sediment-water interfaces, *Model studies, *Nutrients, Phytoplankton, Eutrophic water, Dissolved oxygen, Phosphorus, Nitrogen, Oxygen, Iron, Sulfides.

A model for assessing eutrophic water and sediment quality, with a focus on the exchange of nutrients between water and sediments, and on the primary production of phytoplankton, was applied to a simplified core system consisting of two layers of water and two layers of sediment. The fundamental elements were phosphorus, nitrogen, oxygen, and iron. Sulfide ions were regarded as debts of dissolved oxygen (DO), and ferric oxide as a source of DO, respectively. The oxidized zone (ferric oxide), which has a certain capacity of phosphate adsorption, is formed by the reaction of active iron in the upper layer of sediment, with DO in the lower layer of water. The oxidized zone is reduced by the sulfide ions in the upper layer of sediments, allowing an equal part of the phosphate to be released. The supply of phosphorus and nitrogen to the sediment depends upon the settling of phytoplankton from water. The phytoplankton then decompose, and are partially adsorbed to the clay surface or to the oxidized zone. Released nutrients diffuse upward toward the water or downward the lower layer of sediments. Nutrients which diffuse upward are assimilated by phytoplankton which settle onto sediments and recycle in the same manner. The main parameters were changed seasonally as a function of temperature. Using this model, the characteristic patterns of seasonal variation of phosphate discharge from sediments, the DO concentration in water, and the rise and fall of the oxidized zone were satisfactorily simulated. (See also W87-03248) (Author's abstract)
W87-03251

RESULTS OF SEDIMENTATION AND ELUTRIATE TESTS FROM OSAKA BAY SEDIMENT,
Japan Sediments Management Association.
H. Kosasa, K. Nikaido, and M. Natori.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 211-221, 13 fig, 3 tab.

Descriptors: *Sedimentation, *Osaka Bay, Elutriation, Sedimentology, Japan, Sediments, Nutrients, Sedimentation rates, Suspended solids, Phosphorus, Orthophosphate, Oxidation.

Sediment samples were taken from the Osaka Bay area, with sediment quantities of 150 liters sampled from four points. The grain-size distribution was obtained by three methods: conventional soil mechanics methods, photo-extinction, and a coulter counter. The sedimentation tests were carried out principally to learn the effects of coagulants on sedimentation. From these curves it is readily apparent that the settling velocities decrease with increasing sediment concentration. Therefore, dredging with higher sediment concentration is not always advantageous from the point of view of sedimentation. The void ratio of the settled material at each point can also be determined from the sedimentation curves. The initial void ratio of the sediment as it lies on the sea bottom is 6.43 w = 240%, gamma s = 2.76). The volumes of the solid particles, expressed as percentages of the total volume, were 3.51%, 7.79%, and 13.6%, respectively, for the three sediment concentrations of 10%, 25%, and 40%. Elutriate tests were conducted to learn the effects of sediment content as elutriates. Elutriate concentrations decreased according to the increase in suspended solid concentrations in the samples. The elutriate behavior of phosphorus is different from other materials, with the phosphorus concentration of elutriates reaching a maximum after 1 minute, and then rapidly decreasing. This is caused by the generation of iron phosphate precipitates from oxidation, during agitation. Dissolved orthophosphate (ORP) is mobilized from the bottom sediment of standing water as a result of oxygen depletion, and the formation of H2S at the sediment-water interface. A 'barrier layer' consisting of iron (III) phosphate and iron (III) hydroxide serves as a sink for phosphorus and is destroyed by the reduction process. (See also W87-03248) (Lantz-PTT)
W87-03258

PARTIAL REVIEW OF DREDGED MATERIAL DISPOSAL TECHNIQUES,
Nishiki Consultant Co. Ltd., Tokyo (Japan).
For primary bibliographic entry see Field 5E.
W87-03259

DEWATERING OF BOTTOM SEDIMENTS,
Science Univ. of Tokyo (Japan).
Z. Yoshino, K. Sato, H. Okajima, F. Kodama, and S. Taguchi.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 249-261, 15 fig, 1 tab, 16 ref.

Descriptors: *Dewatering, *Bottom sediments, *Sludge drying, *Wastewater treatment, Sands, Mathematical analysis, Shinobazu Pond, Lake Kasumigaura, Filtration, Mathematical analysis, Mathematical equations, Water reuse, Japan.

The properties and dewatering characteristic of various bottom sediments were examined, and it was found that these sediments were very difficult to dewater by conventional methods because of the extremely high specific resistance and the excessive compressibility. The sandy materials contained in the sediments were easily recovered by the hydroseparater. Comparative studies were made on a dewatering process available for troublesome sludge, and the continuous vacuum precoat filter was chosen as the most effective dewaterer by theoretical and experimental investigations. According to field experimental investigations at Shinobazu Pond and Lake Kasumigaura, the following data have been extracted: (1) The sediments could be efficiently dewatered with the continuous vacuum precoat filter; (2) The filtrate capacity may be expressed by the following equation: S = V/(At) + K . w to the -1/2 . t to the -1/2, where V = filtrate volume, t = dewatering time, A = filtration area, K = filtration constant, and w = solid content; (3) Filtrates discharged from the continuous vacuum precoat filter, had a suspended solids concentration as low as 10 mg/L, clear enough for pumping back into the lake or reusing as process water; and (4) The moisture content of the cake removed from the continuous vacuum precoat filter was less than 50%, and therefore eligible for disposal or reuse as a fertilizer. From the theoretical and experimental investigations, the continuous vacuum precoat filter may be the best method available for the treatment of bottom sediments from both a technical and an environmental viewpoint. (See also W87-03248) (Lantz-PTT)
W87-03261

WEATHERING REACTIONS, WATER CHEMISTRY AND DENUDATION RATES IN DRAINAGE BASINS OF DIFFERENT BEDROCK TYPES: I - SANDSTONE AND SHALE,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 2K.
W87-03288

DENUDATION OF THE PICEANCE CREEK BASIN, COLORADO,
Geological Survey, Denver, CO.
E. D. Andrews.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 205-215, 3 fig, 1 tab, 13 ref.

Descriptors: *Piceance Creek, *Denudation, *Basins, Erosion, Catchment areas, Suspended sediments, Dissolved solids, Groundwater pollution, Semiarid lands, Groundwater movement, Water pollution sources, Carbonates, Erosion rates.

An analysis of hydrological and geomorphological data collected in the Piceance Creek basin provides detailed information concerning the transport of dissolved solids and suspended sediment in seven small semiarid drainage basins. Chemical weathering within the zone of shallow groundwater circulation contributes more than 13,400 t/yr (46%) of the mean annual dissolved solids load at the mouth of Piceance Creek. Measured suspended sediment yields are very small (2.35-25.6 t/sq km/yr) compared to most semiarid drainage basins. Nevertheless, measured hillslope erosion rates are locally quite large, up to 4,000 t/sq km/yr. Repeated profile surveys of selected hillslopes and ephemeral channels show that large quantities of sediment are being deposited in some areas. Compared to most semiarid drainage basins, a large percentage (36%) of the total denudation is removed from the basin as dissolved load. Rapid dissolution of carbonate cement in the near-surface rock material, and deposition of a large quantity of sediment within and adjacent to ephemeral tributaries, appear to account for this anomalous condition. (See also W87-03272) (Author's abstract)
W87-03289

DISSOLVED AND PARTICULATE LOAD IN DANISH WATER COURSES,
Copenhagen Univ. (Denmark). Inst. of Geography.
For primary bibliographic entry see Field 5B.
W87-03293

CHEMICAL EROSION MEASUREMENTS IN THE MASSIF DES MAURES: THE EXAMPLE OF THE RIMBAUD DRAINAGE BASIN (VAR, FRANCE)(MESURES DE L'EROSION CHIMIQUE DANS LE MASSIF DES MAURES: L'EXEMPLE DU BASIN VERSANT DU RIMBAUD (VAR, FRANCE)),
Centre National de la Recherche Scientifique, Paris (France).
For primary bibliographic entry see Field 2K.
W87-03294

INFLUENCE OF CATASTROPHIC FLOODS ON WATER QUALITY AS RECORDED IN THE SEDIMENTS OF BLAGDON LAKE, ENGLAND,
Polytechnic Wolverhampton (England).
For primary bibliographic entry see Field 2H.
W87-03306

MEASURING SUSPENDED SEDIMENT IN SMALL MOUNTAIN STREAMS,
Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.
For primary bibliographic entry see Field 5A.
W87-03324

CONTROLLING SUSPENDED SEDIMENT SAMPLERS BY PROGRAMMABLE CALCULATOR AND INTERFACE CIRCUITRY,
Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.
For primary bibliographic entry see Field 7B.
W87-03337

2K. Chemical Processes

ATMOSPHERIC METHANE SOURCES: ALASKAN TUNDRA BOGS, AN ALPINE FEN, AND A SUBARCTIC BOREAL MARSH,
National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
For primary bibliographic entry see Field 5B.
W87-02719

PRESERVATION OF TRACES OF CHROMIUM(VI) IN WATER AND WASTE WATER SAMPLES,
CIBA-GEIGY A.G., Basel (Switzerland). Central Analytical Dept.
For primary bibliographic entry see Field 5A.
W87-02804

LAKE ACIDIFICATION AND THE LAND-USE HYPOTHESIS: A MID-POST-GLACIAL ANALOGUE,
University Coll., London (England). Palaeoeco-

logy Research Unit.
V. J. Jones, A. C. Stevenson, and R. W. Battarbee.
Nature NATUAS, Vol. 322, No. 6075, p 157-158, July 10, 1986. 1 fig, 19 ref.

Descriptors: *Lake acidification, *Lakes, *Acidic water, *Land use, *Water pollution sources, *Acid rain, Soil chemistry, Catchment areas, Rainfall, Sediments, Pollen, Diatoms, Peat, Acidity, Air pollution effects.

It has been suggested that the recent acidification of lakes owes more to catchment soil acidification than to acid deposition. This can be tested by assessing the effect of catchment soil changes on lake acidity during earlier periods of post-glacial time, when acid deposition was presumably minimal. The mid-post-glacial formation of blanket mires in the catchments of British lakes sensitive to acidification provides a suitable analogue. Results of a pollen and diatom study of a sediment core from a recently acidified lake in Galloway, Scotland are used to show that the lake was acid (pH 5.5-6.0) before peat formation and that no acidification occurred while peat was developing in the catchment. Acidification to pH values < 5 occurs only after AD 1850, during the period of increasing acid emissions from fossil fuel combustion. It is concluded that soil acidification is probably not the cause of the very low pH values found in many acidified lakes today. (Author's abstract)
W87-02810

TEMPORAL EVOLUTION OF NITROGEN COMPOUNDS IN SWEDISH PRECIPITATION SINCE 1955,
Stockholm Univ. (Sweden). Meteorologiska Institutionen.
For primary bibliographic entry see Field 2B.
W87-02812

SALINE- VERSUS FRESHWATER CONTRIBUTION TO THE THERMAL WATERS OF THE NORTHERN JORDAN RIFT VALLEY, ISRAEL,
Geological Survey of Israel, Jerusalem.
For primary bibliographic entry see Field 2F.
W87-02852

BIOACCUMULATION OF ARSENIC BY FRESHWATER ALGAE AND THE APPLICATION TO THE REMOVAL OF INORGANIC ARSENIC FROM AN AQUEOUS PHASE: PART II. BY CHLORELLA VULGARIS ISOLATED FROM ARSENIC-POLLUTED ENVIRONMENT,
Kagoshima Univ. (Japan). Dept. of Applied Chemistry.
For primary bibliographic entry see Field 5B.
W87-02907

SPECIATION OF MANGANESE IN FRESHWATERS,
Queensland Univ., Brisbane (Australia). Dept. of Chemistry.
B. Chiswell, and M. B. Mokhtar.
Talanta TLNTA2, Vol. 33, No. 8, p 669-677, August 1986. 64 ref.

Descriptors: *Managanese speciation, *Water chemistry, *Fresh water, *Electron paramagnetic resonance spectroscopy, Anodic stripping voltammetry, Complexation, Organic ligands, Oxides, Solubility.

The extent of current knowledge regarding speciation of Mn in fresh waters is reviewed and analytical methods are discussed, with particular reference to the use of electron paramagnetic resonance spectroscopy. The most likely form of soluble Mn in fresh water is Mn(2+)(aq), although the possibility of complexation, particularly of the outer-sphere type, with naturally occurring organic ligands cannot be ruled out. If such complexation does occur, it may stabilize both Mn(III) and Mn(IV) species. The speciation of insoluble Mn in fresh waters may include one or more of the following: (1) one or many of the forms of MnO2 and Mn(II), (2) Mn(III), or Mn(IV) oxides adsorbed on either insoluble organic or inorganic material, annd (3) insoluble Mn(II), Mn(III), or Mn(IV) complexes. The difficulty of oxidizing Mn(II) in fresh waters is well-known, but the mechanisms are not understood; mediation by biological species may be essential. Anodic-stripping voltammetry and the use of ion-exchange resins and electron paramagetic resonance spectrometry have been useful in determining soluble Mn speciation in fresh waters. (Rochester-PTT)
W87-03051

MODELLING THE EFFECTS OF ACIDIC DEPOSITION AND CONIFER AFFORESTATION ON STREAM ACIDITY IN THE BRITISH UPLANDS,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 5C.
W87-03068

ORGANIC WATER: ISOTOPIC CHARACTERIZATION AND EVIDENCE FOR ITS ROLE IN THE FEDJ-EL-ADOUM PB-ZN DEPOSIT, TUNISIA (EAU ORGANIQUE: CARACTERISATION ISOTOPIQUE ET EVIDENCE DE SON ROLE DANS LE GISEMENT PB-ZN DE FEDJ-EL-ADOUM, TUNISIE),
For primary bibliographic entry see Field 5B.
W87-03090

ARSENIC DISTRIBUTIONS IN POREWATERS AND SEDIMENTS OF PUGET SOUND, LAKE WASHINGTON, THE WASHINGTON COAST AND SAANICH INLET, B.C.,
Washington Univ., Seattle. School of Oceanography.
For primary bibliographic entry see Field 5B.
W87-03133

STUDY OF FOAMY THERMOMINERAL WATER OF FRENCH MASSIF CENTRAL. I. OXIDATION-REDUCTION POTENTIAL AND BEHAVIOR OF IRON (ETUDE DES EAUX THERMOMINEARALES CARBOGAZEUSES DU MASSIF CENTRAL FRANCAIS. I. POTENTIEL D'OXYDO-REDUCTION ET COMPORTEMENT DU FER),
Bureau de Recherches Geologiques et Minieres, Orleans (France). Inst. Mixte de Recherches Geothermiques.
For primary bibliographic entry see Field 5B.
W87-03134

BIOGENIC METHANE FORMATION IN MARINE AND FRESHWATER ENVIRONMENTS: CO2 REDUCTION VS. ACETATE FERMENTATION-ISOTOPE EVIDENCE,
Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hanover (Germany, F.R.).
For primary bibliographic entry see Field 5B.
W87-03137

EARLY DIAGENESIS OF CADMIUM AND COBALT IN SEDIMENTS OF THE LAURENTIAN TROUGH,
Quebec Univ., Rimouski. Dept. of Oceanography.
For primary bibliographic entry see Field 5B.
W87-03138

CHEMICAL CONTROL OF SOLUBLE PHOSPHORUS IN THE AMAZON ESTUARY,
Harvard Univ., Cambridge, MA. Center for Earth and Planetary Physics.
For primary bibliographic entry see Field 5B.
W87-03139

ACYCLIC ARCHAEBACTERIAL ETHER LIPIDS IN SWAMP SEDIMENTS,
University of South Florida, St. Petersburg. Dept. of Marine Science.
For primary bibliographic entry see Field 5A.
W87-03141

EFFECT OF OXYGEN ON RELEASE AND UPTAKE OF COBALT, MANGANESE, IRON AND PHOSPHATE AT THE SEDIMENT-WATER INTERFACE,
Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Analytical and Marine Chemistry.
For primary bibliographic entry see Field 5B.
W87-03143

BENTHIC FLUXES OF CADMIUM, COPPER, NICKEL, ZINC AND LEAD IN THE COASTAL ENVIRONMENT,
Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Analytical and Marine Chemistry.
For primary bibliographic entry see Field 5B.
W87-03144

THERMODYNAMIC STUDY OF SOLUTIONS OF LIQUID HYDROCARBON MIXTURES IN WATER,
Virginia Inst. of Marine Science, Gloucester Point.
For primary bibliographic entry see Field 1B.
W87-03145

STUDY OF FOAMY THERMOMINERAL WATER OF FRENCH MASSIF CENTRAL. II. BEHAVIOR OF SOME TRACE METALS, ARSENIC, ANTIMONY AND GERMANIUM, (ETUDE DES EAUX THERMOMINERALES CARBOGAZEUSES DU MASSIF CENTRAL FRANCAIS. II. COMPORTEMENT DE QUELQUES METAUX EN TRACE, DE L'ARSENIC, DE L'ANTIMOINE ET DU GERMANIUM),
Bureau de Recherches Geologiques et Minieres, Orleans (France). Inst. Mixte de Recherches Geothermiques.
A. Criaud, and C. Fouillac.
Geochimica et Cosmochimica Acta GCACAK, Vol. 50, No. 8, p 1573-1582, August 1986. 14 fig, 3 tab, 34 ref.

Descriptors: *Thermomineral water, *Spring water, *Carbon dioxide, *France, *Trace metals, *Arsenic, *Antimony, *Germanium, Atomic absorption spectroscopy, Mineralization, Hydrogen ion concentration, Temperature effects, Carbonates, Ferric hydroxide, Silica, Oxidation, Hydrothermal studies, Clay minerals, Silica, Heavy metals, Concentration.

Carbon dioxide rich spring waters were sampled and analyzed for Co, Ni, Cu, Pb, Cd, Cr, As, Sb and Ge by graphite furnace atomic absorption spectroscopy. The springs belong to two groups corresponding to possible events which may occur during the ascent of thermomineral water: cooling without major modification of mineralization (Vichy springs) or mixing at constant temperatures (Val les Bains springs). The influence of these phenomena on trace element behavior is presented. Because of changes in pH, temperature, mineralization and redox conditions, water-rock interactions increase and the new conditions allow higher concentrations of metals than in the deep fluid. The calculated distribution of aqueous species indicates the importance of bicarbonate complexes in the transport of divalent metals. Total dissolved concentrations are limited by the solubility of carbonates or absorption of ferric hydroxide. As, Sb, and Ge are dissolved under hydrothermal conditions and their concentrations tend to decrease when deep fluid cools or mixes with superficial water. Ge behavior seems to differ from that of silica. The influence of the oxidation state is demonstrated for As and Sb which are involved with precipitation of clay minerals, silica or ferric hydroxides. (See also W87-03134) (Author's abstract)
W87-03146

RESULTS OF SEDIMENTATION AND ELUTRIATE TESTS FROM OSAKA BAY SEDIMENT,
Japan Sediments Management Association.
For primary bibliographic entry see Field 2J.
W87-03258

DISSOLVED LOADS OF RIVERS AND SURFACE WATER QUANTITY/QUALITY RELATIONSHIPS.
International Association of Hydrological Sciences.
For primary bibliographic entry see Field 5B.
W87-03272

DISSOLVED LOADS OF RIVERS: A GLOBAL OVERVIEW,
Exeter Univ. (England).
For primary bibliographic entry see Field 5B.
W87-03273

VARIATION IN SOLUTE CONCENTRATION WITHIN THE RIVER ALMOND AND ITS EFFECT ON THE ESTIMATED DISSOLVED LOAD,
Ministry of Higher Education and Scientific Research, Baghdad (Iraq).
For primary bibliographic entry see Field 5B.
W87-03274

SOLUTE YIELD FROM A GLACIERIZED HIGH MOUNTAIN BASIN,
Victoria Univ. of Manchester (England). Dept. of Geology.
For primary bibliographic entry see Field 5B.
W87-03276

DISSOLVED MATERIAL CONCENTRATION IN SURFACE WATERS OF AFRICA. TWO CONTRASTING EXAMPLES IN THE RIVERS OF TOGO AND THE MEDJERDAH IN TUNISIA (EVOLUTION DE LA CONCENTRATION EN MATIERES DISSOUTES EN AFRIQUE. DEUX EXEMPLES OPPOSES: LES FLEUVES DU TOGO ET LA MEDJERDAH EN TUNISIE),
Office de la Recherche Scientifique et Technique Outre-Mer, Bondy (France).
For primary bibliographic entry see Field 5B.
W87-03277

MECHANISMS OF DISSOLVED SOLIDS TRANSPORT IN FLYSCH DRAINAGE BASINS,
Polish Academy of Sciences, Krakow. Inst. of Geography and Spatial Organization.
For primary bibliographic entry see Field 5B.
W87-03281

FACTORS CONTROLLING THE CHEMICAL COMPOSITION OF RIVER WATERS OF INDIA,
Jawaharlal Nehru Univ., New Delhi (India). School of Environmental Sciences.
For primary bibliographic entry see Field 2E.
W87-03285

STREAM SOLUTE BEHAVIOUR IN THE RIVER EXE BASIN, DEVON, UK,
Exeter Univ. (England).
For primary bibliographic entry see Field 5B.
W87-03286

ATMOSPHERIC INPUTS AND RIVER TRANSPORT OF DISSOLVED SUBSTANCES,
Ecole Normale Superieure, Paris (France). Lab. de Geologie.
For primary bibliographic entry see Field 2B.
W87-03287

WEATHERING REACTIONS, WATER CHEMISTRY AND DENUDATION RATES IN DRAINAGE BASINS OF DIFFERENT BEDROCK TYPES: I - SANDSTONE AND SHALE,
Geological Survey, Reston, VA.
A. A. Afifi, and O. P. Bricker.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 193-203, 5 fig, 5 tab, 7 ref.

Descriptors: *Weathering, *Catchment areas, *Chemical analysis, *Bedrock, Sandstone, Shale, Virginia, Mill Run, Orthoclase, Plagioclase, Amphibole, Pyrite, Iron hydroxide, Kaolinite, Erosion.

The main tributary of a 4.7 sq km forested drainage basin in Virginia, Mill Run, drains surficial sediments of Cenozoic age and Silurian Massanutten sandstone. Weathering reactions are occurring in the 60 cm soil zone which contains mechanically disintegrated sandstone gravel of the Massanutten sandstone. The streamwater chemistry of Mill Run can be explained by incongruent dissolution of orthoclase, plagioclase, amphibole, and pyrite with precipitation of iron hydroxide, and kaolinite or amorphous materials of similar composition. A chemical denudation rate of 5601 kg/sq km/yr was estimated, which is equivalent to the lowering of surface relief by 0.002 mm/yr. A secondary tributary receiving water in contact with the Silurian Bloomsburg shale was also investigated. In this case, the water chemistry can be explained by dissolution of feldspars, amphibole, and carbonate minerals and precipitation of iron hydroxide, and kaolinite. A chemical denudation rate of 24,888 kg/sq km/yr was estimated, which is equivalent to the lowering of surface relief by 0.010 mm/yr. (See also W87-03272) (Author's abstract)
W87-03288

DENUDATION OF THE PICEANCE CREEK BASIN, COLORADO,
Geological Survey, Denver, CO.
For primary bibliographic entry see Field 2J.
W87-03289

CHEMICAL MASS BALANCE OF A SMALL BASIN IN A WET MONSOONAL ENVIRONMENT AND THE EFFECT OF FAST-GROWING PLANTATION FOREST,
Vrije Univ., Amsterdam (Netherlands). Inst. voor Aardwetenschappen.
For primary bibliographic entry see Field 2H.
W87-03291

BIOGEOCHEMICAL CONTROLS ON RIVER WATER QUALITY IN A FORESTED DRAINAGE BASIN, WARWICKSHIRE, UK,
Coventry (Lanchester) Polytechnic (England). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W87-03292

DISSOLVED AND PARTICULATE LOAD IN DANISH WATER COURSES,
Copenhagen Univ. (Denmark). Inst. of Geography.
For primary bibliographic entry see Field 5B.
W87-03293

CHEMICAL EROSION MEASUREMENTS IN THE MASSIF DES MAURES: THE EXAMPLE OF THE RIMBAUD DRAINAGE BASIN (VAR, FRANCE)(MESURES DE L'EROSION CHIMIQUE DANS LE MASSIF DES MAURES: L'EXEMPLE DU BASIN VERSANT DU RIMBAUD (VAR, FRANCE)),
Centre National de la Recherche Scientifique, Paris (France).
C. Martin.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 265-276, 11 tab, 18 ref.

Descriptors: *Chemical erosion, *Massif des Maures, *France, *Catchment areas, Gneiss, Geochemistry, Dissolved solids, Leaching, Denudation, Weathering.

Observations are made about a small hummocky gneissic drainage basin, with skeletal soils, in a rainy mediterranean climate (P = 1222 mm, T = 12.2 C). Various correlations between hydrochemical and hydrological data allow the mean annual hydrogeochemical balance to be calculated. The total losses of dissolved solids are 7.9 t of oxides/sq km/yr, but the leaching sequence of elements show that the basin contains hidden carbonate rocks, and that K(+) occurs in the perennial biomass. Indeed, the gneiss erosion represents 7.6 t of oxides/sq km/yr. The current geochemical evolution appears to be very bisiallitic, but the collected data provide evidence of a past monosiallitic weathering environment. The losses of Na(+) indicate, for the gneiss, a rate of transformation in soils of 96 mm/kyear and, more generally, a rate of weathering lowering of 26 mm/kyear. (See also W87-03272) (Author's abstract)
W87-03294

STREAM SOLUTE SOURCES AND VARIATIONS IN A TEMPERATE GRANITE DRAINAGE BASIN,
Plymouth Polytechnic (England). Dept. of Geographical Sciences.
For primary bibliographic entry see Field 5B.
W87-03296

2L. Estuaries

STRUCTURING OF ECOLOGICAL DATA SETS BY METHODS OF CORRELATION AND CLUSTER ANALYSIS,
Kiel Univ. (Germany, F.R.). Inst. fuer Polarokologie.
M. Bolter, and M. Meyer.
Ecological Modelling, Vol. 32, No. 1-3, p 1-13, June 1986. 3 fig, 2 tab, 23 ref.

Descriptors: *Ecological data, *Correlation, *Cluster analysis, *Kiel Fjord, *Non-parametric statistics, Mathematical models, Correlation matrices, Germany, Algorithms, Baltic Sea, Plankton, Seasonal variation, Data interpretation.

Ecological data sets from marine environments can be classified as either (1) data from stations, i.e., quasi-synoptic approaches for the description of different biotopes or (2) data from seasonal investigations, i.e., surveys of time-dependent changes in the environment. The authors propose that non-parametric statistics be employed to overcome the inhomogeneity of the parameters and their interactions in these data sets, in which nonlinearity and feedback mechanisms may be assumed to exist. Analysis of the resulting correlation matrices can be conducted by different clustering algorithms and shows holistically significant patterns of the structure of the system and leads to the description of interacting subsystems at different levels. The proposed approach was used (1) to demonstrate, in an annual cycle of data on the microbial environment in the Kiel Fjord (Baltic Sea), distinct seasonal patterns that can be attributed to the general planktonic environment and (2) to show, by analysis of data sets from different stations, the separation of a 'unique' environment into units of different structures caused by influences of the current or other dominating environmental factors. These results point to the strong spatial heterogeneity of marine systems, indicate their response on different nutritional sources, and reflect the change in the interrelationships. (Rochester-PTT)
W87-02597

STATISTICAL TECHNIQUE FOR ANALYSIS OF ENVIRONMENTAL DATA CONTAINING PERIODIC VARIANCE COMPONENTS,
Northeast Utilities Service Co., Hartford, CT.
For primary bibliographic entry see Field 7C.
W87-02599

MODELLING OF THE LOWER TROPHIC LEVELS OF A MARINE ECOSYSTEM AND ITS EXAMPLE OF SHORT-PERIOD VARIATIONS OF CHLOROPHYLL AND NUTRIENT IN HARIMA-NADA,
Hokkaido Univ., Sapporo (Japan). Dept. of Electrical Engineering.
A. Ohuchi, J. Fukuoka, A. Miyakoshi, and M. Suzuki.
Ecological Modelling, Vol. 32, No. 1-3, p 149-163,

June 1986. 9 fig, 3 tab, 18 ref.

Descriptors: *Chlorophyll, *Nutrients, *Seto Inland Sea, *Harima-nada, *Ecological models, *Marine ecosystem, *Trophic levels, Mathematical models, Japan, Impulse response, Frequency response, Turbulent diffusion, Chlorophyll, Nutrients, Phytoplankton.

A mathematical model that is applicable to the euphotic zone of an ecosystem with simple biotic components and biological activity in an inland sea permits the analysis of the balance behavior of the low trophic level at scales of several days and kilometers. System stability was considered in relation to a small nutrient disturbance to the model and responses were analyzed using the impulse response and frequency response techniques. From the frequency response, it was seen that phytoplankton values responded sharply to a nutrient response in a low frequency domain. In the intermediate and high-frequency domains, the phytoplankton gain decreased. The same tendency was observed in short-period variations in chlorophyll and nutrients in Harima-nada of the Seto Inland Sea (Japan). From continuous observations during 24 hr in summer 1979 and 1980, it was apparent that, in the variations of few-minute periods, turbulent diffusion dominates the chlorophyll and nutrient fluctuations. In variations of several-hour periods, however, the fluctuations of chlorophyll were not dependent on the physical process (e.g., ocean current) but on the biological process. Thus, model results and observation coincided for the biological process in a low-frequency domain. (Rochester-PTT)
W87-02601

PATTERNS IN DISTRIBUTION AND ABUNDANCE OF A NONCOEVOLVED ASSEMBLAGE OF ESTUARINE FISHES IN CALIFORNIA,
California Univ., Davis. Dept. of Wildlife and Fisheries Biology.
P. B. Moyle, R. A. Daniels, B. Herbold, and D. M. Baltz.
Fishery Bulletin FSYBAY, Vol. 84, No. 1, p 105-117, 1986. 6 fig, 5 tab, 29 ref. Calif. Dept. of Water Resources Project 3930-H.

Descriptors: *Distribution patterns, *Population density, *Fish, *Estuarine environment, *California, *Ecology, Estuaries, Environment, Population dynamics, Density, Fish populations, Populations, Marshes, Wetlands, Ecological distribution, Salinity, Temperature, Species composition, Seasonal distribution, Species diversity.

The patterns of distribution and abundance of the fishes of Suisun Marsh, a portion of the Sacramento-San Joaquin estuary in central California, were studied over a 54-month period. Total fish abundance in the marsh exhibited strong seasonality; numbers and biomass were lowest in winter and spring and highest in late summer. Freshwater inflow was highest in the winter and lowest in late summer, when salinities and temperatures were highest. Twenty-one species were collected on a regular basis; another 21 species occurred in small numbers on an irregular basis. Twenty of the 42 species had been introduced to California since 1879. Both resident and seasonal species were mixtures of native and introduced species. Total fish abundance and species diversity declined through the study period, which seemed to be related to strong year classes of some species early in the study and the prevalance of freshwater conditions late in the study. The structure of the fish assemblage was fairly consistent over the study period, but changes are expected in the near future. The structure of the Suisun Marsh fish assemblage was similar to that found in other river-dominated estuaries, despite the mixture of native and introduced species. (Author's abstract)
W87-02758

ORGANIC AND TRACE METAL LEVELS IN OCEAN QUAHOG, ARCTICA ISLANDICA LINNE, FROM THE NORTHWESTERN ATLANTIC,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Lab.
For primary bibliographic entry see Field 5B.
W87-02759

ECOLOGY AND ESTUARINE IMPACT ASSESSMENT: LESSONS LEARNED FROM THE HUDSON RIVER (U.S.A.) AND OTHER ESTUARINE EXPERIENCES,
Cornell Univ., Ithaca, NY. Ecosystems Research Center.
K. E. Limburg, S. A. Levin, and C. C. Harwell.
Journal of Environmental Management JEVMAW, Vol. 22, No. 3, p 255-280, April 1986. 2 fig, 2 tab, 67 ref. EPA Cooperative agreement CR 811060; NSF Grant DMS-8406472.

Descriptors: *Estuarine environment, *Ecology, *Environmental impact statement, *Hudson River, *Environmental policy, Environment, Estuaries, Legal aspects, Legislation, Environmental protection, Protection, Regulations, Ecosystems, Model studies, Litigation, Risk assessment.

Environmental impact assessment was institutionalized by the National Environmental Policy Act (NEPA) of 1969. However, effective environmental protection requires scientific counsel not only in the performance of measurements and analyses, but in the formulation of environmental legislation, in the development of procedures for implementing legislation, and in providing expert opinions during regulatory and litigative proceedings. In these roles, the scientist must strive for objectivity and must clarify the limitations of predictability and the degree of uncertainty associated with relevant scientific projections. The history of management of the Hudson River is used to develop the role of the scientist in environmental protection. The conceptual and methodological approaches to environmental impact assessment are discussed, emphasizing the need for attention not only to those species recognized for their social, economic, or ecological value, but also to possible effects upon ecosystem structure and function. Field experiments, microcosms and mesocosms, and mathematical models are discussed and set within the context of an overall program of management of estuarine systems. (Author's abstract)
W87-02776

VERTICAL DIFFUSION IN MEROMICTIC POWELL LAKE, BRITISH COLUMBIA,
Memorial Univ. of Newfoundland, St. John's. Dept. of Physics.
For primary bibliographic entry see Field 2H.
W87-02780

RELATIONSHIPS AMONG GROWTH RATE, CELLULAR MANGANESE CONCENTRATIONS AND MANGANESE TRANSPORT KINETICS IN ESTUARINE AND OCEANIC SPECIES OF THE DIATOM THALASSIOSIRA,
National Marine Fisheries Service, Beaufort, NC. Beaufort Lab.
W. G. Sunda, and S. A. Huntsman.
Journal of Phycology JPYLAJ, Vol. 22, No. 3, p 259-270, September 1986. 13 fig, 26 ref.

Descriptors: *Trace elements, *Growth rates, *Manganese, *Tissue analysis, *Kinetics, *Accumulation, *Estuarine environment, *Marine algae, *Diatoms, *Thalassiosira, Environment, Estuaries, Marine plants, Algae, Ions, Cations, Marine environment, Algal growth.

Growth rate, cellular manganese concentration, and manganese uptake kinetics were measured as functions of the free manganese ion concentration in the medium for two centric diatoms. Thalassiosira oceanica, isolated from a low-manganese marine environment, grew better at low manganese ion concentrations than T. pseudonana, isolated from high-manganese estuarine waters. This was due to the marine species' greater ability to accumulate manganese at low free ion concentrations and to grow well at lower cellular manganese concentrations. Manganese uptake in both species followed classical saturation kinetics. The substrate saturated uptake rate (V sub max) appeared to be under negative feedback control in both species, and six- to 12-fold variations in this parameter allowed cells to regulate cellular manganese at nearly constant values at manganese ion concentrations at or below the half-saturation constant, K sub s. The range in free manganese ion concentrations over which regulation occurred was different from the two species, and coincided with the range in free manganese ion concentrations of the natural habitat of each species. (Author's abstract)
W87-02805

EFFECTS OF TEMPERATURE, SALINITY, IRRADIANCE AND DIURNAL PERIODICITY ON GROWTH AND PHOTOSYNTHESIS IN THE DIATOM NITZSCHIA AMERICANA: LIGHT-SATURATED GROWTH,
North Carolina State Univ. at Raleigh. Dept. of Marine, Earth and Atmospheric Sciences.
R. L. Miller, and D. L. Kamykowski.
Journal of Phycology JPYLAJ, Vol. 22, No. 3, p 339-348, September 1986. 9 fig, 2 tab, 46 ref.

Descriptors: *Salt tolerance, *Temperature, *Salinity, *Irradiation, *Growth, *Photosynthesis, *Diatoms, *Nitzschia, Algae, Algal growth, Estuarine environment, Environment, Estuaries, Culturing techniques.

The physiological response of an estuarine clone of Nitzschia americana was measured under experimental conditions of temperature and salinity representing the average range of these variables in the Cape Fear River Estuary, North Carolina. The influence of temperature and salinity on specific growth rates and parameters of photosynthesis-irradiance curves were measured during maximum and minimum rates of diurnal photosynthesis using axenic semi-continuous batch cultures maintained at an irradiance saturating for photosynthesis. Growth rate increased with increasing temperature up to a broad optimum at about 25 C, above which it gradually declined. At the predicted optimum temperature, growth rate increased as a linear function of salinity. Both light-limited and light-saturated rates of photosynthesis increased as salinity decreased. The effect of temperature on photosynthesis was complex and dependent on salinity. Growth efficiency, calculated as the ratio between specific growth rates and rates of gross photosynthesis, increased with an increase in salinity with a maximum at the predicted optimum temperature and salinity of 25 C and 32%, suggesting an uncoupling between photosynthesis and growth at non-optimum growth conditions. (Author's abstract)
W87-02807

EFFECTS OF LIGHT ON GROWTH, RUBPCASE ACTIVITY AND CHEMICAL COMPOSITION OF ULVA SPECIES (CHLOROPHYTA),
Duke Univ., Beaufort, NC. Marine Lab.
C. S. Duke, B. E. Lapointe, and J. Ramus.
Journal of Phycology JPYLAJ, Vol. 22, No. 3, p 362-370, September 1986. 6 fig, 8 tab, 28 ref. NSF Grants OCE-81-13328, DEB-81-21290.

Descriptors: *Light, *Growth rate, *Enzymes, *Chemical composition, *Ulva, *Chlorophyta, *Ribulose biphosphate carboxylase, Temperature, Nutrients, Nitrogen, Pigments, Growth, Algae, Algal growth.

The effects of light on growth, ribulose bisphosphate carboxylase-oxygenase (RuBPCase) activity, and chemical composition of Ulva curvata and U. lactuca were examined at a range of temperatures and N-supply levels. Growth of Ulva species becomes more light-dependent with increasing temperature and N. The effect of light on RuBPCase is N-dependent, with a positive correlation under N-sufficient and a negative correlation under N-limited conditions. Light effects on pigment levels and ratios may also be independent of effects on growth rate. These interactions uncouple growth rate from RuBPCase and pigments, and thus from tissue %N. The limits of variability of the growth-%N relationship can be described by a parabola. Under relative light- or temperature-limitation, %N is negatively correlated with growth rate, while under relative N-limitation, growth increases with increasing %N. It is concluded that tight

coupling of seaweed growth and chemical composition may be relatively rare in natural waters where growth can be simultaneously limited by light, temperature, and N. (Author's abstract)
W87-02809

SIMPLE APPROXIMATION FOR A MOVING INTERFACE IN A COASTAL AQUIFER,
Queensland Univ., Brisbane (Australia). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W87-02851

MODELING OF POLLUTANT DISPERSION IN STRATIFIED OSCILLATORY FLOWS,
California Univ., Berkeley. Sanitary Engineering Research Lab.
For primary bibliographic entry see Field 5B.
W87-02885

SLACK TIDE OXYGEN BALANCE MODEL,
Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5B.
W87-02889

CHARACTERIZATION AND CLASSIFICATION OF SEASIDE-SALT-MARSH SOILS ON VIRGINIA'S EASTERN SHORE,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Agronomy.
W. J. Edmonds, P. R. Cobb, and C. D. Peacock.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 3, p 672-678, May-June 1986. 4 fig, 5 tab, 23 ref.

Descriptors: *Classification, *Salt marshes, *Salt, *Marsh plants, *Virginia, Halmyric soil, Soil properties, Sulfides, Soil taxonomy, Soil water, Mud flats, Marshes, Clay.

Current concepts consider salt marshes to have a very high biomass, this study was conducted to characterize soils in seaside salt marshes on Virginia's eastern shore, and to classify them according to criteria in 'Soil Taxonomy' and proposed amendments. Salt-meadow marshes, dominantly vegetated by salt-meadow hay, contain soils with halmyric and non-sulfidic properties and aquic moisture regimes. This will broaden the definition of halmyric materials to include an aquic moisture regime, and the definition of the argillic horizon, to include sodium adsorption ratios (SARs) considerably greater than 13. The authors propose that soils in these marshes with subsoil illuvial clay accumulations and SARs greater than 13, be classified as members of Typic Natraqualfs even though they lack the structure currently defined for natric horizons. Salt-marsh cordgrass marshes, contain soils with halmyric and sulfidic properties, silty textures, and peraquic moisture regimes. Tidal mudflats, not vegetated by vascular plants, contain sediments that have halmyric, but dominantly non-sulfidic properties. Conditions necessary for the formation and accumulation of sulfide minerals exists salt-marsh-cordgrass marshes and to a limited extent in the tidal mudflats and in the salt-meadow marshes. Moist incubation of samples provides a convenient and economical method for evaluating soils and sediments as sulfidic materials. Results of this study support the need for the proposed amendments to Soil Taxonomy. (Author's abstract)
W87-02919

STUDY ON THE MODELLING OF THE BEHAVIOR OF PHOSPHORUS RELEASED FROM SEDIMENTS,
Yamaguchi Univ. (Japan). Div. of Sanitary Engineering.
H. Nakanishi, M. Ukita, and Y. Kawai.
Ecological Modelling, ECMODT Vol. 31, No. 1-4, p 105-123, May 1986. 17 fig, 3 tab, 16 ref.

Descriptors: *Coastal waters, *Path of pollutants, *Nutrients, *Mathematical models, *Eutrophic waters, *Sediments, *Phytoplankton, *Nitrogen, *Phosphorus, *Dissolved oxygen, *Iron, Ferric oxide, Diffusion, Temperature, Seasonal variation, Adsorption.

The exchange of nutrients between water and sediments in eutrophic coastal areas together with primary production of the phytoplankton was studied; modelling was conducted for assessment of eutrophic water and sediment quality. The model was applied to a simplified core system consisting of two layers of water and two layers of sediments. The fundamental elements were P, N, O, and Fe. Sulfide was regarded as a debt of dissolved oxygen (DO) and ferric oxide as a store of DO. An oxidized zone (ferric oxide), which has a certain capacity for phosphate adsorption, is formed with the reaction between active Fe in the upper layer of sediments and DO in the lower layer of water. When the oxidized zone is reduced by the sulfide in the upper layer of sediments, adsorbed phosphates are released equivalently. The supply of P and N to the sediments depends on sinking phytoplankton; when the phytoplankton decompose part of their nutrient content is adsorbed to the clay surface of the oxidized zone. Released nutrients diffuse upward to the water or downward to the lower layer of sediments. The main parameters are changed seasonally as a function of temperature. This model satisfactorily simulated the characteristic patterns of seasonal variation of phosphate discharge from sediments, DO concentration in the water, and the rise and fall of the oxidized zone in coastal embayments of Japan were well simulated. (Rochester-PTT)
W87-02967

INTERACTION BETWEEN MOTILE PHYTOPLANKTON AND LANGMUIR CIRCULATION,
National Inst. for Environmental Studies, Tsukuba (Japan). Lab. of Marine Environment.
M. Watanabe, and A. Harashima.
Ecological Modelling, ECMODT Vol. 31, No. 1-4, p 175-183, May 1986. 6 fig, 26 ref.

Descriptors: *Flagellates, *Langmuir circulation, *Phytoplankton, *Motility, *Mathematical models, Simulation, Convection cells, Cultures, Distribution, Velocity.

The motile flagellate Heterosigma akashiwo was grown in pure culture in a 60 cm x 30 cm x 3 cm container using f/2 medium: Vertical convection cells with Langmuir circulation were simulated by a diffuser, and the distribution of H. akashiwo was measured. A stream function in the convection cells simulated a trajectory of motile phytoplankton in convection cells. A non-dimensional parameter R = V sub p/V sub 0 (where V sub p is a speed of motion of motile phytoplankton and V sub 0 is a maximum velocity in convection cells) determines the accumulation of flagellates and the regions of retention. The simulation results explained the distribution of H. akashiwo observed in experiments. (Author's abstract)
W87-02969

SEASONAL ABUNDANCE, GROWTH, FEEDING AND AGE COMPOSITION OF FLOUNDER (PLATICHTHYS FLESUS (L.)) POPULATIONS OF THE SEVERN ESTUARY AND BRISTOL CHANNEL,
Bath Univ. (England). School of Biological Sciences.
M. W. Hardisty, and K. S. Badsha.
International Journal of Environmental Studies IJEVAW, Vol. 27, No. 1/2, p 89-114, 1986. 12 fig, 5 tab, 39 ref.

Descriptors: *Flounders, *Severn Estuary, *Bristol Channel, Nuclear powerplants, Barnstaple Bay, England, Age composition, Abundance, Growth, Seasonal variations, Length-weight relationships, Impingement, Fish food, Fish food organisms.

Between 1972 and 1977, flounders were collected in weekly samples from the trash bins of the Oldbury-on-Severn nuclear power stations on the inner estuary and occasional samples were taken from the nearby Berkeley power station and from the Hinkley Point power station and Barnstaple Bay on the outer estuary and Bristol Channel. These collections enabled studies to be made of season and annual changes in relative abundance, age composition, growth rates, diet, and feeding habits. Seasonal changes in environmental factors, seasonal and annual changes in abundance, length-frequency distributions, age composition of the population, growth rates, condition factors in relation to length-weight relationships, seasonal variations in feeding intensity, food organisms, and seasonal changes in diet are reported. (Rochester-PTT)
W87-03027

ZOOPLANKTON FAUNA OF KILLARY HARBOUR: THE SEASONAL CYCLE OF ABUNDANCE,
Shellfish Research Lab., Carna (Ireland).
T. H. Ryan, P. G. Rodhouse, C. M. Roden, and M. P. Hensey.
Journal of the Marine Biological Association of the United Kingdom JMBAAK, Vol. 66, No. 3, p 731-748, August 1986. 5 fig, 21 ref. National Board of Science and Technology (Ireland) Grant HEIC/11/79.

Descriptors: *Killary Harbor, *Zooplankton, *Seasonal variation, *Freshwater discharge, Estuarine environment, Aquatic animals, Ireland, Neritic waters, Inshore waters, Salinity, Reproduction, Ecology.

As part of a study of the production ecology of the Killary Harbor inlet (Ireland), the zooplankton fauna was sampled quantitatively at 2-wk intervals between February 1981 and January 1982, using nets with mesh apertures of 90 and 335 micron. The dominant holozooplankton species of Killary Harbor are typical of inshore or neritic waters, but there are also representatives of estuarine and oceanic faunas. Inflow of water into the bay below the surface layer of low salinity apparently maintains conditions suitable for neritic species and accounts for similarities between the zooplankton faunas inside and outside the bay. Large populations of estuarine species presumably do not develop because of the variability of freshwater discharge. During September 1981 there was evidence of freshwater intrusion into the bay. (Author's abstract)
W87-03054

EXTREME VALUE THEORY BASED ON THE R LARGEST ANNUAL EVENTS,
Imperial Coll. of Science and Technology, London (England). Dept. of Mathematics.
R. L. Smith.
Journal of Hydrology JHYDA7, Vol. 86, No. 1/2, p 27-43, September 1986. 3 fig, 1 tab, 8 ref, append.

Descriptors: *Water level fluctuations, *Mathematical studies, *Extreme value theory, *Annual events, *Venice, Estimating, Periodicity, *Statistical analysis, Mathematical models, Random variables, Empirical results, Mathematical equations, Theoretical analysis.

A family of statistical distributions and estimators for extreme values based on a fixed number r > or = 1 of the largest annual events is presented. The distributions are based on the asymptotic joint distribution of the r largest values in a single sample, and the method of estimation is numerical maximum likelihood. This is treated as if it were the exact joint distribution of the observations, and the unknown parameters estimated by the method of maximum likelihood. Standard errors of the estimates may be obtained using either the observed or expected information matrix, the two being in very good agreement in our example. The likelihood function may be used to compare different models, such as may arise from different functional forms of trend. In the Venice data where the method was applied to the sea levels, the main contribution to trend was a linear trend from 1931 onward. The astronomical 18.62-yr cycle has only a very small effect. A rather larger 11-yr cycle was observed but it is not known whether this has any physical explanation. The large value of sigma (a parameter of the cumulative distribution function of annual maximum) implies that there will always be a very large scatter in the predicted annual maxima. The

theoretical efficiencies of using different values of r may be compared on the basis of the expected information matrix. The assumptions of the model dictate, however, that r must be kept small in practice. (Lantz-PTT)
W87-03069

DIRECT DETERMINATION OF CD, CU AND NI IN THE ELBE RIVER ESTUARY WITH ZEEMAN AAS AND MATRIX MODIFICATION (DIREKTBESTIMMUNG VON CD, CU AND NI IM ELBEASTUAR MIT HILFE DER ZEEMAN-ATOMABSORPTIONSSPEKTROSKOPIE UND MATRIXMODIFIKATION),
Technische Univ. Hamburg-Harburg (Germany, F.R.). Arbeitsbereich Umweltschutztechnik.
For primary bibliographic entry see Field 5A.
W87-03087

SURVIVORSHIP AND SPATIAL DEVELOPMENT OF SPARTINA ALTERNIFLORA LOISEL. (GRAMINEAE) SEEDLINGS IN A NEW ENGLAND SALT MARSH,
Brown Univ., Providence, RI. Graduate Program in Ecology and Evolutionary Biology.
W. S. Metcalfe, A. M. Ellison, and M. D. Bertness.
Annals of Botany ANBOA4, Vol. 58, No. 2, p 249-258, August 1986. 2 fig, 5 tab, 26 ref. NSF Grant DEB 82-05747.

Descriptors: *Spartina, *Reproduction, *Plant growth, Rhode Island, Colonization, Seedlings, Tillers, Leaf area ratios, Growing season, Photosynthesis, Plant physiology, Survival.

Patterns of survival and spatial arrangement of tillers of Spartina alterniflora were examine in natural and artificially produced bare areas and in pure stands of adult S. alterniflora in salt marsh in Rumstick Cove, Barrington, Rhode Island. Seedling growth and survival were high in naturally occurring bare patches and in artificial patches, whether created by continual clipping of adult plants to the ground or by providing bare substrate after removal of adult plants. Seedling growth and survivor ship increased with increasing size of bare area. In large bare areas, S. alterniflora seedlings grew non-directionally, reaching heights of 0.5 m, and producing as many as 36 tillers in one growing season. Examination of leaf area ratios suggested that the production of tillers increased photosynthetic capacity in seedlings with several tillers in contrast to seedlings without tillers. Thus, seedlings can apparently tiller and colonize free space radially without a loss of photosynthetic capacity. These results suggest that, whereas seedling success is generally limited by adult plants in monocultures of S. alterniflora, in disturbed spaces seedling success is high and results in a rapid non-directional proliferation of sexually generated clones that ultimately preclude the successful invasion of future seedlings. (Author's abstract)
W87-03096

IMPACTS FROM MOSQUITO CONTROL-INDUCED SULPHUR MOBILIZATION IN A CAPE COD ESTUARY,
National Park Service, Boston, MA. Office of Scientific Studies.
For primary bibliographic entry see Field 5C.
W87-03127

STEMMING THE LOSS OF COASTAL WETLAND HABITATS: JAMAICA AS A MODEL FOR TROPICAL DEVELOPING COUNTRIES,
Florida International Univ., Miami. Dept. of Biological Sciences.
A. Thorhaug, and B. Miller.
Environmental Conservation EVCNA4, Vol. 13, No. 1, p 72-73, Spring 1986. 2 fig, 5 ref.

Descriptors: *Jamaica, *Coastal zone management, *Wetlands, *Habitats, *Model studies, *Policy making, Coastal waters, Environmental policy, Rehabilitation.

Tropical nations are implementing new policies and regulations to protect coastal habitats and their associated fisheries from industrial and other 'development,' which erodes away the natural resource-bases if left unmanaged. To overcome the ill-effects of rapid industrial, urban, and tourist, expansion along the 420 miles (672 km) coastline, with its accompanying transmigration of inland population towards coastal cities, increasing demophoric pressures, and over a million touristsper year, the island nation of Jamaica has provided a model for the concept of zero-loss policy of their coastal wetlands. With the knowledge that it would be technically feasible to rehabilitate major littoral habitats, the following three-pronged policy approach was suggested for the use of the Jamaican Government: (1) To have a regulatory basis for claiming damage and requiring restoration of resources after accidents to coastal habitats (for instance oil-spills, mining spills, and harbour or navigation accidents). (2) To formulate policy so that future coastline development would be required for replacement of critical habitat if removed for necessary development - alternatives for any such removal being first exhausted. (3) To guide a national policy of remedying past wetland mistakes prior to environmental legislation, with concomitant reafforestation programs. Decimated coastal areas would gradually be rehabilitated in a planned sequence. (Alexander-PTT)
W87-03128

EARLY DIAGENESIS OF CADMIUM AND COBALT IN SEDIMENTS OF THE LAURENTIAN TROUGH,
Quebec Univ., Rimouski. Dept. of Oceanography.
For primary bibliographic entry see Field 5B.
W87-03138

CHEMICAL CONTROL OF SOLUBLE PHOSPHORUS IN THE AMAZON ESTUARY,
Harvard Univ., Cambridge, MA. Center for Earth and Planetary Physics.
For primary bibliographic entry see Field 5B.
W87-03139

GEOCHEMISTRY OF TIN IN RIVERS AND ESTUARIES,
Florida State Univ., Tallahassee. Dept. of Oceanography.
For primary bibliographic entry see Field 5B.
W87-03140

DETERMINATION OF ORGANICALLY-ASSOCIATED TRACE METALS IN ESTUARINE SEA-WATER BY SOLVENT EXTRACTION AND ATOMIC-ABSORPTION SPECTROMETRY,
Hiroshima Univ. (Japan). Faculty of Integrated Arts and Sciences.
For primary bibliographic entry see Field 5A.
W87-03173

LOCATION OF AN INTERFACE OBSERVATION WELL: A BAYESIAN APPROACH,
Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.
For primary bibliographic entry see Field 2F.
W87-03187

BIOMASS AND STRUCTURE OF A SPARTINA ALTERNIFLORA LOISEL.-DOMINATED SALT MARSH IN FRANCE,
Delaware Univ., Lewes. Coll. of Marine Studies.
M. F. Gross, V. Klemas, and J. E. Levasseur.
Torrey Botanical Club Bulletin, Vol. 113, No. 2, p 125-130, April-June, 1986. 1 tab, 30 ref. NASA Grant Nos. NAGW-374 and NAS-5-27580, and CNEXCO/Universite de Rennes I Contract 83/72-07.

Descriptors: *Spartina alterniflora, *Salt marshes, *France, *Biomass, Elorn River, Brest, Marsh plants, Ecosystems, Tidal marshes, Distribution patterns, Phenology.

A Spartina alterniflora Loisel. (Gramineae)-dominated salt marsh located along the Elorn River at about 48.5 N latitude near Brest, France, was studied to determine the distribution and zonation of the various plant species and to evaluate the biomass and other characteristics of S. alterniflora growing near the northern limit of its range in its non-native Europe. A general salt marsh community occupies the high marsh. Halimione partulacoides Aellen lines the tidal creekbanks, but not the Elorn River banks. The remainder of the marsh is dominated by three distinct zones of S. alterniflora descending in elevation from the high marsh: middle marsh, wrack zone, and riverbank. The mean mid-August live aerial biomass of riverbank, wrack zone and middle marsh S. alterniflora was 1181 + or - 86 gdw/sq m, 832 + or - 90 gdw/sq m, and 992 = or - 48 gdw/sq m, respectively. The height of the riverbank plants, the stem density in the middle marsh, and the dead biomass in the wrack zone were all significantly greater than the corresponding values for the other two zones. The presence of one stand of S. alterniflora which flowered in early July, a month earlier than the other plants, suggests that there were multiple North American latitudinal origins of the S. alterniflora growing in this marsh. (Author's abstract)
W87-03203

GROWTH AND SURVIVAL OF GIANT RAGWEED (AMBROSIA TRIFIDA L.) IN A DELAWARE RIVER FRESHWATER TIDAL WETLAND,
Rutgers - The State Univ., Camden, NJ. Dept. of Biology.
For primary bibliographic entry see Field 2H.
W87-03207

EFFECT OF O2 CONCENTRATION ON DARK H2 OXIDATION IN WHOLE CELLS OF A MARINE SULFUR PHOTOSYNTHETIC BACTERIUM (CHROMATIUM SP. STRAIN MIAMI PBS 1071),
Institute of Physical and Chemical Research, Saitama (Japan).
S. Kumazawa, T. Ogawa, Y. Inoue, and A. Mitsui.
Plant and Cell Physiology PCPHA, Vol. 26, No. 8, p 1485-1491, 1985. 5 fig, 15 ref.

Descriptors: *Oxygen, *Hydrogen, *Oxidation, *Marine bacteria, Bacteria, Chromatium, Ubiquinone, Photosynthetic bacteria, Electron transport.

Whole cells of photoanaerobically grown Chromatium sp. strain Miama PBS 1071, a marine purple sulfur bacterium, oxidized H2 in the dark through the oxyhydrogen reaction. Oxidation of H2 was measured by injecting either H2 into an air-equilibrated cell suspension (aerobic H2 oxidation) or O2 into an H2/Ar-equilibrated cell suspension (microaerobic H2 oxidation). Both types of H2 oxidation were strongly inhibited by azide (40 millimoles), indicating that the oxidation proceeds via a terminal oxidase system. 2,5-Dibromo-3-methyl-6-isopropyl-p-benzoquinone (16 micromoles) inhibited aerobic H2 oxidation by 49%, but it accelerated microaerobic H2 oxidation. The sensitivity of H2 oxidation to rotenone was higher under aerobic conditions. The results indicate that H2 oxidation to rotenone was higher under aerobic conditions. The results indicate that H2 oxidation proceeds via two different pathways: one contains ubiquinone and NAD, and the other does not. The contribution of each pathway depends on the O2 partial pressure. (Author's abstract)
W87-03211

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

NEED FOR FLUORIDATION OF DESALINATED WATER SUPPLIES,
For primary bibliographic entry see Field 5F.
W87-03041

REVERSE OSMOSIS CAN BE COST EFFECTIVE,

M. Ashton.
Public Works PUWOAH, Vol. 117, No. 8, p 55, August 1986.

Descriptors: *Reverse osmosis, *Cost analysis, *Desalination, *Water treatment facilities, Feed pressure, Cape Coral, Florida, Lime softening plants, Energy conservation.

The rapidly growing city of Cape Coral (Florida) found that building a 7 million gal/day low pressure reverse osmosis (RO) plant was the least expensive way to increase its water treatment capacity. The total capital cost for site preparation, 12 production wells (700-900 feet deep), 6 monitoring wells, raw water transmission piping, brine discharge piping, and a 5 million gallon storage tank was $7.9 million. Use of the new RO plant in conjunction with a pre-existing RO plant results in lower overall operation and maintenance (production) costs for water than a lime softening plant or the lime softening plant plus the old RO facilities. One of the main cost savings was in electricity, due to lowering the feed pressure with a resultant saving of almost 45% on electricity bills. (Rochester-PTT)
W87-03079

3B. Water Yield Improvement

ANALYSIS AND CARTOGRAPHICAL APPROACH TO THE REGIONAL WATER UTILIZATION SYSTEM IN THE YODO RIVER BASIN,
Osaka Univ. (Japan). Dept. of Environmental Engineering.
For primary bibliographic entry see Field 6D.
W87-02978

INTERIM PROGRESS REPORT, VOLUME I: SCPP METEOROLOGICAL AND STATISTICAL SUPPORT FOR PERIOD 1 SEPTEMBER 1984 THROUGH 31 AUGUST 1985,
Electronic Techniques, Inc., Fort Collins, CO.
For primary bibliographic entry see Field 2B.
W87-03327

3C. Use Of Water Of Impaired Quality

SPATIAL VARIABILITY AND SOIL SAMPLING FOR SALINITY AND SODICITY APPRAISAL IN SURFACE IRRIGATED ORCHARDS,
Texas A and M Univ., El Paso. Agricultural Research Station.
For primary bibliographic entry see Field 2G.
W87-02726

RESPONSE OF LETTUCE CULTIVARS TO SLUDGE-AMENDED SOILS AND BED TYPES,
Wisconsin Univ.-Madison. Dept. of Horticulture.
H. C. Harrison.
Communications in Soil Science and Plant Analysis, Vol. 17, No. 2, p 159-172, February 1986. 2 fig, 2 tab, 19 ref.

Descriptors: *Lettuce, *Impaired water use, *Sludge utilization, Nutrients, Leaves, Soil amendments, Municipal wastes, Industrial wastes, Plant growth.

The effects of sludge, bed and genotype on lettuce growth and leaf elemental concentration levels were studied in a two year nutrition experiment. Three lettuce cultivars were grown in field plots of silt loam amended with 90 mt/ha/year applications of industrial or municipal sludge and a control with no sludge applied. The three bed types included a level or flat bed, a raised bed and a raised bed of unamended topsoil over a prepared flat bed. Sludge and bed type influenced yield and leaf elemental concentrations for all three cultivars. Highest yields were associated with municipal sludge and raised beds and highest leaf nutrient concentrations with industrial sludge. Bed effects on leaf elemental concentrations were variable. One cultivar had significantly lower leaf concentration levels for all elements when compared with the other two. (Michael-PTT)
W87-02880

TRICKLE IRRIGATION OF WHEAT APPLYING RENOVATED WASTEWATER,
Ben-Gurion Univ. of the Negev, Sde Boker (Israel). Jacob Blaustein Inst. for Desert Research.
For primary bibliographic entry see Field 3F.
W87-02938

PROBLEMS OF USING WASTEWATER ON VEGETABLE CROPS,
Kansas Agricultural Experiment Station, Manhattan. Evapotranspiration Lab.
M. B. Kirkham.
Hortscience, Vol. 21, No. 1, p 24-27, February 1986. 2 tab, 52 ref.

Descriptors: *Secondary wastewater, *Wastewater irrigation, *Vegetable crops, Suspended solids, Soil temperature, Waste heat, Salinity, Calcium, Magnesium, Boron, Toxicity, Nitrates, Contamination, Heavy metals, Fluorine, Viruses, Bacteria, Aerosols, Effluents, Ecological effects, Water reuse.

Physical, chemical and biological problems associated with using secondary effluent for vegetable production are reviewed. Physical problems include accumulation of suspended solids and soil warming after the use of power plant waste heat. Chemical problems include concentration of salinity, calcium and magnesium, boron toxicity, nitrate contamination and accumulation of heavy metals and fluorine. Biological problems include risk of infection posed by surviving viruses and possible dispersion of bacteria contained in effluent aerosols. (Michael-PTT)
W87-02954

TRICKLE IRRIGATION SYSTEM FOR RECYCLING RESIDENTIAL WASTEWATER ON FRUIT TREES,
Great Lakes Irrigation Ltd., Hart, MI.
J. Gamble.
Hortscience, Vol. 21, No. 1, p 28-32, February 1986. 6 fig, 1 tab, 16 ref.

Descriptors: *Trickle irrigation, *Wastewater irrigation, *Recycling, *Orchards, Wastewater disposal, Wastewater facilities, Wastewater treatment, Chlorination, Michigan, Wastewater collection, Tertiary wastewater treatment, Cost analysis, Pumps.

A wastewater disposal system that uses trickle irrigation for disposal of treated wastewater in existing fruit orchards in Michigan is described. The raw wastewater collection system includes grinder and submersible pump systems to transmit wastewater between the gravity collection systems and treatment facility which consists of four oxidation-reduction ponds. Treated wastewater is discharged by irrigation to provide tertiary treatment. The irrigation system consists of chlorination equipment, two pumps, a filter system, piping and a drip irrigation system. Construction costs for this system were slightly higher than those for other land disposal methods due to a relatively conservative system design, additional regulatory involvement and contractor unfamiliarity with this method of waste disposal. Advantages of this method include odor-free operation and low operating costs, one-half of which are paid through a lease-back arrangement with the orchard operator. (Michael-PTT)
W87-02955

INTERACTIVE EFFECTS OF SEWAGE EFFLUENT IRRIGATION AND SUPPLEMENTAL FERTILIZATION ON CONTAINER-GROWN TREES,
Fort Lauderdale Research and Education Center, FL.
G. Fitzpatrick, H. Donselman, and N. S. Carter.
Hortscience, Vol. 21, No. 1, p 92-93, February 1986. 1 tab, 13 ref.

Descriptors: *Wastewater irrigation, *Effluents, *Ornamentals, *Fertilization, *Trees, Secondary wastewater, Plant growth, Horticulture, Irrigation.

One of the most important aspects of efficient horticultural production is irrigation. Adequate water of acceptable quality can be a limiting factor, and in times of water short-ages, water rationing has a significant and profound effect on plant growth in horticultural crops. Water shortages, caused by drought conditions or governmental regulation, have served as an impetus to evaluate irrigation source alternatives. Twenty species of ornamental trees were grown in containers, six of which were irrigated with tap water while another six were irrigated with secondary sewage effluent. Three individuals within each irrigation treatment received supplemental fertilization, while the other three remained unfertilized. Effluent irrigation accelerated growth in four and supplmental fertilization accelerated growth in seven species. species. Significant interaction occurred between irrigation and fertilization in three species. The remaining eight species grew at rates that were not significantly influenced either by source of irrigation or supplemental fertilization. (Michael-PTT)
W87-02958

ECOLOGICAL MODELLING, MONITORING AND IMPLEMENTATION IN IRRIGATED AGRICULTURE,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
For primary bibliographic entry see Field 3F.
W87-02966

ROOT CONTROL OF LEAF PHOSPHORUS AND CHLORINE ACCUMULATION IN SOYBEAN UNDER SALINITY STRESS,
Agricultural Research Service, Riverside, CA. Salinity Lab.
For primary bibliographic entry see Field 2I.
W87-02984

SALINITY TOLERANCE OF WINGED BEAN AS COMPARED WITH THAT OF SOYBEAN,
Maryland Univ., College Park.
R. R. Weil, and N. A. Khalil.
Agronomy Journal AGJOAT, Vol. 78, No. 1, p 67-70, January-February 1986. 1 fig, 1 tab, 16 ref.

Descriptors: *Soybeans, *Salt tolerance, *Salinity, *Germination, *Plant growth, Leaves, Food crops. Agriculture, Crop yield, Sandy soil, Nitrogen fixation.

The salt tolerance of winged bean and soybean cultivars was compared. Plants were grown in pots of sandy soil amended with NaCl. Dry matter accumulation, nodule mass and tissue of winged bean were similar to the two studied soybean cultivars at low electrical conductivities (EC). At 65 days after planting, specific nitrogenase activity by acetylene reduction assay was much lower for the winged bean than for soybean. The results indicated that winged bean was at least as tolerant as one soybean cultivar and more tolerant than the other. Winged bean showed less foliar injury than either soybean cultivar. The tissue N content of soybean was unchanged during saltwater treatment, but increased significantly in winged bean with increasing salinity. This suggests that dry matter accumulation in winged bean may be more sensitive to salinity than nitrogen fixation. (Author's abstract)
W87-02988

EFFECT OF HIGH SULFATE IRRIGATION WATERS ON SOIL SALINITY AND YIELDS,
Agricultural Research Inst., Nicosia (Cyprus). Soils and Water Use Section.
I. Papadopoulos.
Agronomy Journal AGJOAT, Vol. 78, No. 3, p 429-432, May-June 1986. 1 fig, 5 tab, 21 ref.

Descriptors: *Saline soils, *Irrigation effects, *Irrigation water, *Sulfates, Crop yield, Ions, Sodium,

Chlorine, Conductivity, Saline water, Gypsum, Adsorption, Plant growth.

The response of greenhouse-grown tomato, eggplant and bell pepper plants to soil salinity influenced by the ionic composition of naturally occuring sulfate waters was studied in relation to that of rainwater. One of the saline waters was saturated with gypsum and the other contained sulfate ions, sodium and chlorine (mixed water). A leaching fraction was used in all treatments. Soil salt buildup was high with the saline waters. Soil electrical conductivity (EC) increased sharply with ions of both sparingly and highly soluble salts contributing to soil EC. Sulfate concentration at the initial stage increased due to the presence of other ions in the soil solution and was more than twice that of a pure gypsum solution. At the second stage of soil salt buildup, calcium and sulfate concentrations were unchanged and the increase of EC was slower compared to the initial stage. Soil EC increase was higher with mixed water at both stages and a significant increase of soil solution sodium adsorption ratio occurred. Fruit yields of tomato and eggplant were reduced when irrigated with the mixed or sulfate water as compared with rainwater. Lower yield was due to smaller fruit size. Yield of bell pepper was not affected, but its quality deteriorated. (Author's abstract)
W87-02996

IRRIGATION INTERVAL AS A FACTOR IN SWEET CORN RESPONSE TO SALINITY,
J. Shalhevet, A. Vinten, and A. Meiri.
Agronomy Journal AGJOAT, Vol. 78, No. 3, p 539-545, May-June 1986. 4 fig, 5 tab, 18 ref.

Descriptors: *Irrigation effects, *Saline water, *Corn, Soil water Solutes, Salinity, Plant growth, Crop yield, Water use, Conductivity, Field tests, Ions, Chlorine, Sodium, Potassium, Calcium, Accumulation, Regression analysis.

The hypothesis that shortening saline water irrigation intervals will reduce salinity damage by increasing mean soil water content and reducing mean solute potential was tested by determining the interaction of irrigation intervals on growth, yield and water uptake of sweet corn. The field experiment consisted of various irrigation intervals at different irrigation water salinities in a factorial design using regression analysis. The amount of water that was applied equalled the amount needed to replenish soil water deficit as measured by neutron scattering. The regression of absolute yield on mean electrical conductivity of the soil saturation extract showed a steeper yield decrease with increasing conductivity for the 3.5 day interval as compared with longer intervals. The relative yield response to salinity showed the same benefit of shortening the irrigation interval with saline as with nonsaline water. This lack of interaction on relative yield was to due an increase in mean electrical conductivity as the irrigation interval was shortened. Leaf chlorine and nitrogen ionic content tripled. Potassium ionic content increased while calcium content was unaffected as water salinity increased. (Michael-PTT)
W87-03003

POTASSIUM UTILIZATION AND FLUXES IN WILD SALT-TOLERANT RELATIVES OF THE CULTIVATED TOMATO,
Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Biology.
For primary bibliographic entry see Field 2I.
W87-03055

EFFECTS OF SEAWATER ON AMINO ACIDS AND MINERAL IONS COMPOSITION IN SALICORNIA BRACHIATA ROXB,
Bhavnagar Univ. (India). Dept. of Life Sciences.
A. J. Joshi.
Journal of Plant Physiology JPPHEY, Vol. 123, No. 5, p 497-502, June 1986. 1 fig, 3 tab, 17 ref.

Descriptors: *Halophytes, *Salicornia brachiata, *Seawater, *Amino acids, *Salts, *Ions, Alanine, Aspartic acid, Glutamic acid, Glycine, Proline, Serine, Isoleucine, Leucine, Methionine, Valine, Sodium, Potassium, Chlorides, Conductivity, Plant physiology, Salinity, Accumulation, Field test.

Effects of natural seawater salinities varying from 20 to 50 mS/cm on accumulation of free amino acids and inorganic ions in Salicornia brachiata were studied. Concentrations of alanine, aspartic acid, glutamic acid, glycine, proline, and serine were more than those of isoleucine, leucine, methionine, and valine. Most of the amino acids showed maximum accumulation in vegetative plants under 40 mS/cm salinity, except glycine, which was maximum in flowering plants under 50 mS/cm. Increase in Na(+), K(+), and Cl(-) accumulation and significant compensation of cations by Cl(-) was observed. Ion content in pot-grown plants at various growth stages showed close similarities with field observations. (Author's abstract)
W87-03093

GROWTH AND NUTRITIONAL STATUS OF PETUNIA AND TOMATO SEEDLINGS WITH ACIDIFIED IRRIGATION WATER,
Purdue Univ., Lafayette, IN. Dept. of Horticulture.
For primary bibliographic entry see Field 5C.
W87-03105

MICROBIAL ASPECTS OF WASTEWATER REUSE FOR IRRIGATION,
Arizona Univ., Tucson. Dept. of Microbiology and Immunology.
J. B. Rose.
CRC Critical Reviews in Environmental Control CCECAU, Vol. 16, No. 3, p 231-256, 1986. 3 fig, 13 tab, 88 ref.

Descriptors: *Microbiological studies, *Wastewater irrigation, Microorganisms, Risk, Diseases, Epidemiology, Crop production, Pathogenic bacteria, Parasites, Enteroviruses, Enterobacteria, Aerosols, Irrigation practices, Irrigation effects, Contamination, Survival, Water reuse.

Microorganisms present in wastewater used for irrigation were listed and the risk of disease transmission through contact with wastewater or crops, soils or other wastewater contaminated materials was discussed. Pathogenic microorganisms include bacteria, parasitic protozoa and helminths and enteric viruses. Disease outbreaks associated with wastewater irrigation were described and evidence of disease transmission through aerosolization of wastewater and epidemiological studies of wastewater exposure were evaluated. Factors influencing the prevalence and survival of microbial pathogens on several wastewater irrigated food crops were examined. Regulatory criteria for minimizing contamination risks from wastewater irrigation were also discussed. (Michael-PTT)
W87-03129

MIXED-CULTURE MICROBIAL PROTEIN FROM WASTE SULFITE PULPING LIQUOR II: ITS PRODUCTION ON A PILOT-PLANT SCALE AND USE IN ANIMAL FEED,
Quebec Univ., Trois-Rivieres. Centre de Recherche en Pates et Papiers.
For primary bibliographic entry see Field 5E.
W87-03132

AMMONIUM (15N) METABOLISM IN COTTON UNDER SALT STRESS,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 5C.
W87-03151

RESPONSES OF LETTUCE TO SALINITY. I. EFFECTS OF NACL AND NA2SO4 ON GROWTH,
California Univ., Davis. Dept. of Vegetable Crops.
For primary bibliographic entry see Field 5C.
W87-03154

SALT RESPONSES OF LETTUCE TO SALINITY. II. EFFECT OF CALCIUM ON GROWTH AND MINERAL STATUS,
California Univ., Davis. Dept. of Vegetable Crops.
For primary bibliographic entry see Field 5C.
W87-03155

FORMS OF NITROGEN IN WATERLOGGED SOILS AND THEIR CONTRIBUTION TO YIELD AND NITROGEN UPTAKE BY RICE,
Rajendra Agricultural Univ., Samastipur (India). Dept. of Soil Science and Agricultural Chemistry.
S. S. Prasad, A. K. Sarkar, and N. P. Sinha.
The Journal of Agricultural Science JASIAB, Vol. 107, No. 1, p 215-217, August 1986. 1 tab, 10 ref.

Descriptors: *Waterlogging, *Soil water, *Rice, *Nitrogen accumulation, Ammonium, Nitrates, Fertilizers, Soil chemistry, Plant nutrition, Plant physiology, Tillering, Panicle initiation, Crop yield, Pusa farm, India, Field tests.

A field experiment was conducted to determine the relative distribution of the various chemical forms of N in waterlogged soils of Pusa farm (Bihar, India) and their respective contributions to yield and the N uptake of rice. NH4(+)N constituted 8.8-27.8% of soil N at tillering and panicle initiation stages; application of N as neem cake coated urea and lac coated urea increased the NH4(+)N content of the soil considerably at the tillering stage. NO3(-)N made up 6.0-14.2 mg/kg soil at at tillering and 1.3-7.5 mg/kg at panicle initiation, amounts which represented a very low percentage of total soil N. Hydrolyzable N constituted a high percentage of total soil N, with 17.5-33.6% of total N at tillering and 16.9-37.8% at the time of panicle initiation. Non-hydrolyzable N in waterlogged soil represented the bulk of the soil N. N present in this form ranged from 141 to 434 mg/kg soil at tillering and from 254 to 543 mg/kg soil at the panicle initiation stage. (Rochester-PTT)
W87-03158

WATER OR SALT STRESS INCREASES INFECTIVITY OF ERYSIPHE PISI CONIDIA TAKEN FROM STRESSED PLANTS,
Lancaster Univ., Bailrigg (England). Dept. of Biological Sciences.
For primary bibliographic entry see Field 5C.
W87-03175

PRODUCTION FUNCTION FOR COTTON WITH DATED IRRIGATION QUANTITIES AND QUALITIES,
California Univ., Riverside.
For primary bibliographic entry see Field 3F.
W87-03189

3D. Conservation In Domestic and Municipal Use

WATER SUPPLY IN THE NORTHEAST: A STUDY IN REGULATORY FAILURE,
Indiana Univ. at Bloomington. School of Law.
For primary bibliographic entry see Field 6E.
W87-02590

WATER USE IN URBAN KOREA,
Commonwealth Scientific and Industrial Research Organization, Port Melbourne (Australia). Div. of Mineral Chemistry.
For primary bibliographic entry see Field 6D.
W87-02617

FEASIBILITY OF USING MYCORRHIZAL FUNGI FOR ENHANCEMENT OF PLANT ESTABLISHMENT ON DREDGED MATERIAL DISPOSAL SITES: A LITERATURE REVIEW,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
J. C. Pennington.
Available from the National Technical Information Service, Springfield, VA. 22161 as AD-A170 443, A08 in paper copy, A01 in microfiche. Miscellaneous Paper D-86-3, June 1986. 167 p, 9 fig, 485 ref, append.

Descriptors: *Mycorrhizae, *Soil stabilization, *Soil aggregates, *Soil amendments, *Fungi, *Literature review, *Plant growth, *Soil fungi, Reviews, Dredging, Spoil banks, Waste disposal, Marshes, Aquatic habitats, Revegetation.

Mycorrhizal fungi are one of the most extensively occurring groups of beneficial soil microorganisms. Few plants lack them. Mycorrhizal fungi form an intimate mutualistic association with plant roots (mycorrhizae) that extends the absorptive area of the roots (sometimes thousands of times) and contributes greatly to mineral nutrition, water absorption, and root system stabilization of the host plant. The literature documents increased plant tolerance to adverse or toxic soil conditions by mycorrhizal plants in revegetation of strip-mined sites, kaolin spoils, iron tailings, and processed oil shale. Mycorrhizal plants are consistently more successful in these areas, sometimes exhibiting shoot dry weights 1370 to 1528 percent higher than nonmycorrhizal plants. Not only do mycorrhizae contribute to plant success in adverse substrate conditions, but also have been shown to sequester and store certain heavy metals, thereby detoxifying soils. The extensive external mycelium together with an amorphous polysaccharide secretion are a dominant factor in the aggregation of soil particles by mycorrhizal plants. The effectiveness of these two mechanisms is especially evident in stabilization of sand dunes. These same mechanisms, assisted by additional absorption mechanisms, account for increased soil moisture retention and enhanced water availability and uptake by host plants. This literature review discusses the potential role of mycorrhizal plants in the development of upland, marsh, and aquatic habitats. Tremendous potential exists for enhancing the establishment and growth of vegetation on upland dredged material disposal sites with mycorrhizae. Although much less is known about the mycorrhization of marsh plant species, the limited research available suggests that use of mycorrhizae has some potential for enhancing establishment and growth of marsh plants on dredged material disposal sites. Very few studies of the mycorrhizal status of aquatic plants were found; therefore, the potential for using mycorrhizae to enhance development of aquatic habitat is not known. (Lantz-PTT)
W87-03316

3E. Conservation In Industry

ENERGY RECOVERY SMALL HYDRO PLANTS ON THE RHONE RIVER. THE FIRST MONTHS OF OPERATION OF CHAMPAGNEUX POWER PLANT AND THE SAULT-BRENAZ PROJECT, (LES PETITES CENTRALES DE RECUPERATION SUR LE RHONE. LES PREMIERS MOIS D' EXPLOITATION DE LA CENTRALE DE CHAMPAGNEUX ET LE PROJECT DE SAULT-BRENAZ),
Compagnie Nationale du Rhone, Lyon (France).
For primary bibliographic entry see Field 8C.
W87-02575

3F. Conservation In Agriculture

DEALING WITH THE DROUGHT,
J. D. Aylsworth.
Fruit Grower, Vol. 106, No. 9, p 14, September 1986.

Descriptors: *Drought, *Temperature effects, *Southeastern U.S., *Fruit crops.

The impact of below average rainfall and high temperatures on southeastern fruit growers is assessed. Growers in GA, SC and VA were surveyed to determine the effects of the drought and the measures used to offset the effects. Irrigation was considered to be the solution to the problem. (Michael-PTT)
W87-02565

COMPARISON OF STEADY INFILTRATION SOLUTIONS FOR SPHERICAL CAVITIES UNDER SIMPLE VERSUS VARIABLE HYDRAULIC PROPERTIES,
Griffith Univ., Nathan (Australia). School of Australian Environmental Studies.
For primary bibliographic entry see Field 2G.
W87-02712

DISTRIBUTE WATER EFFECTIVELY,
P. Klassen.
Fruit Grower, Vol. 106, No. 4, p 40, April 1986.

Descriptors: *Orchards, *Irrigation design, *Irrigation efficiency, *Water use efficiency, *Microsprinklers, Sprinklers, Drip irrigation, Wetting, Root zone, Soil profiles.

Drip irrigation individual emitters produce a limited wetted pattern. Research on fruit trees has shown that the smaller wetted area produces a smaller root zone compared to flood or sprinkler irrigation, and concern is this could eventually affect long term room expansion and tree growth. The use of microsprinklers for low volume, low pressure irrigation of large surface areas is described. Criteria and techniques for adapting microsprinklers to fruit orchard watering requirements are also discussed. (Michael-PTT)
W87-02760

TIPS ON TRICKLE,
P. Klassen.
Fruit Grower, Vol. 106, No. 4, p 52-54, April 1986.

Descriptors: *Irrigation practices, *Plant growth, *Trickle irrigation, Orchards, Sprinkler irrigation, Crop yield, Scheduling, Evapotranspiration, Pan evaporation, Irrigation efficiency, Performance evaluation, Herbicides, Drip irrigation, Fruit crops.

Results of studies presented at the International Drip/Trickle Irrigation Congress are reported. One study compared the responses of apple tree growth habits and fruit yield to sprinkler vs. drip irrigation. Sprinkler irrigated trees grew vertically while drip irrigated trees had limbs spreading outwardly. A second study developed methods for determining field performance of irrigation scheduling based on pan evaporation data. A third study evaluated the effects of herbicides under drip and sprinkler irrigation. All the herbicide combinations worked better under low volume sprinklers than they did under drip irrigation in the orchard environment. (Michael-PTT)
W87-02761

ROOT DISTRIBUTION AND WATER UPTAKE PATTERNS OF MAIZE CULTIVARS FIELD-GROWN UNDER DIFFERENTIAL IRRIGATION,
Ife Univ. (Nigeria).
For primary bibliographic entry see Field 2i.
W87-02817

STOCHASTIC DOMINANCE COMPARISON OF WATER-CONSERVING IRRIGATION STRATEGIES,
Nevada Univ., Reno. Dept. of Agricultural and Resource Economics.
T. R. Harris, and H. P. Mapp.
American Journal of Agricultural Economics, Vol. 68, No. 2, p 298-305, May 1986. 2 fig, 44 ref. OWRT Grant No. 14-34-001-9156 and Oklahoma Agricultural Equipment Station Project No. S-1716.

Descriptors: *Stochastic process, *Water conservation, *Irrigation practices, *Irrigation programs, Groundwater depletion, Sorghum, Computer models, Weather, Soil water, Scheduling, Plant growth.

Stochastic dominance and stochastic dominance with respect to a function, were used to compare water conservation irrigation strategies for an area of declining groundwater supplies. A computer based grain sorghum plant growth model, that used weather observations provided the basis for stochastic dominance comparisons. Six irrigation strategies dominate conventional practices by first-degree stochastic dominance and two other strategies exhibit second-degree dominance over contemporary irrigation practices. Dominant strategies involve irrigation based on a 45% soil water criterion and eliminating early season irrigations. Some dominant strategies reduce water use by as much as 40% while increasing expected net returns. (Author's abstract)
W87-02873

EFFECTS OF FREQUENCY OF IRRIGATION ON NUTRIENT UPTAKE OF APPLE TREES,
Department of Agriculture, Summerland (British Columbia). Research Station.
G. H. Neilsen, and D. S. Stevenson.
Canadian Journal of Plant Science CPLSAY, Vol. 66, No. 1, p 177-180, January 1986. 1 tab, 10 ref.

Descriptors: *Apple trees, *Nutrients, *Irrigation practices, Nutrient requirements, Nitrogen, Manganese, Zinc, Calcium, Magnesium, Irrigation programs, Leaves, Potassium.

Throughout the 1980-1983 growing seasons, 'Summerland Red McIntosh' apples (Malus domestica Borkh.) on M.26 rootstock, growning outdoors in large buried pots with a range of N nutrition, were irrigated daily or twice weekly with the same quantity of water (equivalent to 5.9 millimeters/day). Irrigation frequency affected leaf nutrient concentration: leaf Mn and Zn increased in three of four years, leaf Ca and Mg in two years, and leaf N increased in one year, at the daily irrigation frequency. (Author's abstract)
W87-02875

INEXPENSIVE SYSTEM USING DRIP-EMITTERS FOR IRRIGATING SMALL PLOTS,
Department of Agriculture, Melfort (Saskatchewan). Research Station.
S. Bittman, E. -Z. Jan, and G. M. Simpson.
Canadian Journal of Plant Science CPLSAY, Vol. 66, No. 1, p 197-200, January 1986. 3 fig, 6 ref.

Descriptors: *Drip irrigation, *Drip emitters, *Irrigation engineering, *Irrigation practices, Irrigation efficiency, Water quality, Soil types, Infiltration, Soil water, Mechanical equipment.

An system that uses drip emitters for irrigating small plots was designed and tested, to overcome the shortcomings of previously developed irrigators. This system has the following attributes: (1) inexpensive, reliable, with a minimum number of moving parts; (2) uniform application of water on rectangular plots, on all soil types (including sands and cracking clays), even under moderately windy conditions; (3) several plots can be irrigated at once, in any experimental design; (4) controlled rate of application to match rate of soil infiltration; (5) delivery of an exact amount of water; and (6) can be moved on or off plots quickly, without disturbing vegetation or soil. The system performed well when supplied with clean water, but the presence of sediments was found to clog both filters and emitters. (Michael-PTT)
W87-02876

EFFECT OF IRRIGATION AND NITROGEN FERTILIZER ON THE YIELD AND PROTEIN CONTENT OF SOFT WHITE SPRING WHEAT,
Department of Agriculture, Lethbridge (Alberta). Research Station.
J. B. Bole, and S. Dubetz.
Canadian Journal of Plant Science CPLSAY, Vol. 66, No. 2, p 281-289, April 1986. 1 fig, 6 tab, 13 ref.

Descriptors: *Irrigation effects, *Nitrogen, *Crop yield, *Fertilizers, *Proteins, *Wheat, Nitrates, Irrigation practices, Agriculture, Economic evaluation.

Field experiments were conducted over four growing seasons in southern Alberta to develop improved irrigation and nitrogen fertilizer recommendations for soft white spring wheat (Triticum aestivum L.). Irrigation to provide available water in the root zone to maturity maintained acceptably low protein content of soft wheat fertilizer-N plus soil test NO3-N levels from 140 to 208 kg/ha.

Nitrogen fertilizer increased protein content in all four years of the study and increased yields each year except 1981 when the soil contained a high level of NO3-N. The protein content was not raised above the level considered acceptable for the domestic Canadian market(10.5%, moist basis) unless fertilizer rates in excess of the economic optimum level were applied. Fertilizer-N response curves were developed for each cultivar, irrigation treatment and year combination. These were used to show the relationship between yield and level of fertilizer N plus soil NO3-N which would result in economic optimum yields of soft white spring wheat of acceptable protein content. The results suggest N rates can be increased about 30 kg/ha for each t/ha increase in the target yield of the producer. (Author's abstract)
W87-02877

CORN YIELD RESPONSE TO IRRIGATION, PLANT POPULATION AND NITROGEN IN A COOL, HUMID CLIMATE,
Guelph Univ. (Ontario). Dept. of Land Resource Science.
D. M. Brown.
Canadian Journal of Plant Science CPLSAY, Vol. 66, No. 3, p 453-464, July 1986. 4 fig, 7 tab, 15 ref.

Descriptors: *Corn, *Crop yield, *Irrigation effects, *Nitrogen, *Plant growth, *Humid climates, Phenology, Soil water, Irrigation practices, Agriculture, Crop density.

Field studies were conducted to determine the yield response of field corn to midsummer supplemental irrigation when combined with increased plant density and N rates. Yield response, phenological records and soil moisture measurements were used to validate a corn yield estimation model. Two to four line irrigation treatments were applied each year. Development stages were unaffected by irrigation. Yield increases from irrigation were directly proportional to water applied in midsummer, and the intensity of dry weather. Yields increased with plant density in four out of five years and were usually consistent over irrigation levels. Nitrogen added above the recommended rate increased yields in two years, decreased yields in one, and had no effect in the two other years. There was usually a greater response with irrigation to extra nitrogen and those responses were greatest at high plant density and for the longer season hybrids. Harvest indices decreased as irrigation amount increased. (Michael-PTT)
W87-02878

SNOW AND FERTILIZER MANAGEMENT FOR CONTINUOUS ZERO-TILL SPRING WHEAT,
Department of Agriculture, Swift Current (Saskatchewan). Research Station.
C. A. Campbell, W. Nicholaichuk, R. P. Zentner, and J. D. Beaton.
Canadian Journal of Plant Science CPLSAY, Vol. 66, No. 3, p 535-551, July 1986. 5 fig, 5 tab, 32 ref.

Descriptors: *Snow management, *Fertilization, *Wheat, Snow traps, Nitrogen, Soil water, Water use efficiency, Water conservation, Rainfall impact, Crop yield, Urea, Phosphorus, Proteins, Water conservation.

The effects of snow management using cereal straw trap strips, fertilizer management, N use efficiency and moisture conservation, were studied in a zero-till system in southwestern Saskatchewan. Efficiency of soil water intake in short stubble was constant at 29%, but varied in tall stubble. The advantage of water conserved by cereal straw trap strips compared to standard short stubble treatments over the three year study. The use of straw trap strips resulted in greater grain yields than when straw was cut at a standard height, particularly during the driest year. Yields were greater for spring-applied than fall-applied urea N, and for deep-banded as opposed to broadcast N in the two wet years. Fertilizer treatment had no effect on yield in the dry year. Yield response to P applied at high rates was only significant in the second year, but the response was not large. Grain protein and N use efficiency generally responded similarly to grain yield. Although the moisture conserving advantage of trap strips does not so far support a move to continuous cropping in this particular soil zone, yield responses are encouraging and might result in more extensive application of this technique. (Michael-PTT)
W87-02879

SOIL APPLICATION OF A HYDROPHILIC CONDITIONER IN RELATION TO MOISTURE, IRRIGATION FREQUENCY AND CROP GROWTH,
American Univ., Beirut (Lebanon).
M. Baasiri, J. Ryan, M. Mucheik, and S. N. Harik.
Communications in Soil Science and Plant Analysis, Vol. 17, No. 6, June 1986. 2 fig, 2 tab, 8 ref.

Descriptors: *Soil amendments, *Soil moisture retention, *Soil water, *Irrigation practices, *Plant growth, Cucumbers, Available water, Permeability, Sandy soils, Soil pressure, Polycrylamides, Aquastock, Crop yield, Irrigation requirements.

'Aquastock', a polyacrylamide hydrogel, was laboratory tested for moisture retention under varying environments to simulate field conditions in relation to soil properties. A companion greenhouse study evaluated the influence of both the rate and application method of this soil conditioner on cucumber yields and on irrigation frequency. The material increased available water and reduced permeability, particularly in sandy soils. Moisture release under varying soil pressure, and matric potential was favorably influenced by the conditioner. The material significantly increased yield and related crop parameters, and reduced the number of irrigation treatments required. Complete mixing with the soil volume was more effective than partial mixing. 'Aquastock' appears to have potential in semi-arid areas and with protected high value cropping. Further commercial and economic evaluation of this soil conditioner is recommended. (Michael-PTT)
W87-02881

POLYACRYLAMIDE APPLICATION IN IRRIGATION WATER TO INCREASE INFILTRATION,
Agricultural Research Service, Brawley, CA. Irrigated Desert Research Station.
For primary bibliographic entry see Field 2G.
W87-02911

PROFILE MODIFICATION AND IRRIGATION EFFECTS ON YIELD AND WATER USE OF WHEAT,
Agricultural Research Service, Bushland, TX. Conservation and Production Lab.
H. V. Eck.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 3, p 724-729, May-June 1986. 1 fig, 8 tab, 10 ref.

Descriptors: *Irrigation practices, *Irrigation effects, *Crop yield, *Water use, *Wheat, *Soil profiles, *Water use efficiency, Infiltration rate, Bulk density.

Where water is limited, there are continuous searches for management practices that increase water use efficiency (WUE). Profile modification (PM) of Pullman clay loam has been shown to increase the yield and WUE of grain sorghum and alfalfa. It might also increase those of winter wheat. A 4-yr study was conducted at a site on which PM treatments included thorough mixing of the soil profile to 0, 0.9, and 1.5 m with a wheel-type ditching machine. Measurements in 1985 showed that PM still affected the infiltration rate, bulk density, and surface elevation of the soil. Irrigation treatments were: (i) fall irrigation only, (ii) fall irrigation plus one spring irrigation, (iii) fall irrigation plus two spring irrigations, and (iv) fall irrigation plus three spring irrigations. Under irrigation Treatment I, compared to yields on unmodified soil, average grain yields were increased 11% by 0.9-m PM and 20% by 1.5-m PM. With Treatment II, average increases were 16 and 25% respectively, but under treatments III and IV, PM did not affect grain yields. Under irrigation Treatment I, WUE for grain production was increased 10% on 0.9-m PM soil and 16% on 1.5-m PM soil. Under Treatment II, the respective increases were 15 and 21%, but with treatments III and IV, PM had little effect on WUE. Profile modification of Pullman clay loam is not a feasible practice for wheat production because of limited yield response and high energy requirements to accomplish PM. (Author's abstract)
W87-02920

STOCHASTIC APPROACH TO THE CROP YIELD-IRRIGATION RELATIONSHIPS IN HETEROGENEOUS SOILS: I. ANALYSIS OF THE FIELD SPATIAL VARIABILITY,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Dept. of Soil Physics
D. Russo.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 3, p 736-745, May-June 1986. 7 fig, 3 tab, 28 ref.

Descriptors: *Stochastic process, *Crop yield, *Irrigation practices, *Heterogeneous soils, *Spatial distribution, *Mathematical modeling, Salinity, Variogram, Kringing, Satistical models, Soil properties, Soil water, Simulation analysis, Irrigation efficiency.

When a deterministic irrigation regime is applied to a heterogeneous field, soil-water content, soil salinity, and crop yield will vary in space because of the inherent spatial variability in the soil properties. A stochastic approach was used to analyze the spatial variability of four parameters of the soil-water retention curve as well as that of the initial soil-water content and soil salinity, using actual measured field data. These properties were then used as inputs for a simplified crop yield-soil-water model. This was then coupled with the conditional simulation method to analyze the spatial distribution of the calculated soil-water model which in turn, was coupled with the conditional simulation method to analyze the spatial distribution of the calculated soil-water content, soil salinity, and relative crop yield in an irrigated field, for various combinations of irrigation water quantity and quality (salinity). Analysis of the results showed that both irrigation water quantity and quality affected the spatial variability but essentially did not affect the spatial dependence of these properties. The response of different sites in the field was quite different. For some combinations of irrigation water amount and salinity, the relative difference between relative crop yield obtained at different sites in the field exceeded 100%. (See also W87-02922) (Author's abstract)
W87-02921

STOCHASTIC APPROACH TO THE CROP YIELD-IRRIGATION RELATIONSHIPS IN HETEROGENEOUS SOILS: II. APPLICATION TO IRRIGATION MANAGEMENT,
Volcani Inst. of Agricultural Research, Bet-Dagan (Israel). Dept. of Soil Physics
D. Russo.
Soil Science Society of American Journal SSSJD4, Vol. 50, N0. 4, p 745-751, May-June 1986. 5 fig, 2 tab, 10 ref.

Descriptors: *Stochastic process, *Crop yield, *Irrigation practices, *Irrigation engineering, Salinity, Conditional simulation, Spatial distribution, Water use efficiency, Mathematical studies, Soil properties, Simulation analysis.

In a heterogeneous field in which soil properties vary, the crop yield might also differ from place to place in the field, and in turn, reduce the average (over the field) yield relative to that which would be obtained if the soil properties were uniform throughout the field. The simplified crop yield-soil response model, coupled with the conditional simulation method, was used here to evaluate the spatial distribution of the amount of irrigation water required to maintain a prespecified relative crop yield, uniform throughout the field, for a given irrigation water salinity. The amount of irrigation water required to obtain a given relative crop yield can be reduced by 7 to 34%. The

amount of water that could be saved increased as the level of the required crop yield increased and as the salinity of the irrigation water decreased. The optimal amounts of irrigation water can be reduced by 6 to 29%, when the responses of different sites in the field are considered, rather than the average response of the entire field. Irrigation schemes based on the imposition of engineering requirements on the spatial distributions of optimal irrigation water amounts, increased the net benefit by 5.5 to 42% relative to that obtained under deterministic conventional water application schemes. The difference between the two schemes decreased as the irrigation water salinity increased. (See also W87-02921) (Author's abstract)
W87-02922

WHEAT RESIDUE MANAGEMENT EFFECTS ON SOIL WATER STORAGE AND CORN PRODUCTION,
Agricultural Research Service, Bushland, TX. Conservation and Production Lab.
P. W. Unger.
Soil Science Society of America Journal SSJD4, Vol. 50, No. 3, p 764-770, May-June 1986. 4 tab, 9 ref.

Descriptors: *Wheat, *Corn, *Irrigation practices, *Soil water, *Management planning, *Water storage, Fallow, Tillage, Conservation tillage, Water use, Water use efficiency, Infiltration, Crop yield, Agricultural hydrology.

Corn grown in the semiarid southern Great Plains usually is usually irrigated fully the depleting the groundwater supply for irrigation. To decrease the dependence of corn production on the declining groundwater supply, practices must be developed to improve the storage and use of precipitation. This study was conducted to determine the effects of residue management practices after water, from precipitation, storage during fallow; corn growth, yield, and seed quality; and water use and use efficiency by corn. The soil was Pullman clay loam. Relatively little water was stored from precipition during the 1982 to 1983 fallow, because of high initial water contents at the start of fallow in 1982. For the 1983 to 1984 fallow, water storage was higher with disk and sweep tillage than with no-tillage. Water use by corn was not affected significantly by tillage in 1983, but was significantly lower with no-tillage than with disk or sweep tillage in 1984. Corn grain yields were lowest with no-tillage standing residue treatment in 1983, due to a N deficiency. In 1984, yields were not affected significantly by tillage . Kernel weight (mg/kernel) and kernel test weight were affected significantly by tillage in 1983, not in 1984. The study showed that crop residues can be managed to use a greater proportion of precipitation for producing corn, thus reducing the dependence on irrigation. (Author's abstract)
W87-02924

TRICKLE IRRIGATION OF WHEAT APPLYING RENOVATED WASTEWATER,
Ben-Gurion Univ. of the Negev, Sde Boker (Israel). Jacob Blaustein Inst. for Desert Research.
G. Oron, J. DeMalach, and J. E. Bearman.
Water Resources Bulletin WARBAQ, Vol. 22, No. 3, p 439-446, June 1986. 5 fig, 7 tab, 16 ref.

Descriptors: *Wastewater irrigation, *Trickle irrigation, *Wheat, *Effluents, *Wastewater renovation, Irrigation, Sprinkler irrigation, Arid lands, Agriculture, Israel.

Wastewater treatment and usage of recycled water are becoming increasingly necessary in arid zones, especially in the light of the shortage of conventional water sources. The use of effluent for trickle irrigation has become economically more attractive and advantageous than open surface and sprinkler irrigation. In trickle irrigation using effluent, water is being saved and the envrionmental hazard of waste disposal is lessened. The possibilities of irrigating wheat by a trickle system were examined. This was the first phase towards examing the possibility of using a subsurface trickle system for irrigating double cropped wheat and cotton. Treated wastewater was applied for irrigation using a trickle system. Mean total amount of effluent applied was about 5,700 m3/ha, and a grain yield of >10,000 kg/ha was obtained. In three other treatment the yields were about 8,500 kg/ha, which are above the mean yield obtained under sprinkler irrigation. (Author's abstract)
W87-02938

WATER DISTRIBUTION PROFILES FOR SPRINKLERS,
A. C. Sarsfield.
Grounds Maintenance, Vol. 20, No. 10, p 26, 58, October 1985.

Descriptors: *Sprinklers, *Water use efficiency, Water pressure, Wind. Irrigation, Agriculture, Performance evaluation, Distribution profiles.

The concept of developing sprinkler distribution profiles has been used for many years as a method for evaluating sprinkler performance. Tests were made on a single sprinkler by placing a series of catchments (like rain gauges) at various uniform distances from the sprinkler. In actual testing, these are placed in a grid pattern that covers the entire coverage area. By recording the amount in each catchment after the test, the profile is developed and plotted. The individual sprinkler profiles can then be superimposed over each other for different spacings to determine the spacing that will give the greatest uniformity of distribution. The concept of water distribution profiles for sprinklers is defined. Factors that can change the profiles include water pressure and wind patterns. (Michael-PTT)
W87-02946

SPRINKLER SPACING PATTERNS,
A. C. Sarsfield.
Grounds Maintenance, Vol. 20, No. 10, p 28, 30, 32-33, October 1985.

Descriptors: *Sprinklers, *Turf grasses, *Water use efficiency, Sprinkler irrigation, Design criteria, Irrigation.

Sprinkler spacings are critical to the success of a sprinkler irrigation system. These spacings must be chosen with great care and with consideration of the sprinkler's performance, the requirements to be met and climatic conditions especially prevailing winds. Spacings are usually determined as a percentage of the diameter of coverage. The basic patterns used in turf and landscape applications are triangular, square or rectangular. The best uniformity is achieved with perfect equilateral triangular or square spacing patterns, but either can be compressed somewhat (but never stretched) to fit the given area. Sprinkler spacing patterns for watering turf and landscaping are described and formulas for optimizing sprinkler run times are provided. Theoretical sprinkler profiles are also presented. (Michael-PTT)
W87-02947

DRIP AND MINIS, IN THE COMMERCIAL LANDSCAPE,
A. C. Sarsfield.
Grounds Maintenance, Vol. 20, No. 10, p 34, 36, October 1985.

Descriptors: *Sprinklers, *Drip irrigation, *Water use efficiency, Mechanical equipment, Landscaping, Irrigation, Root zone, Horticulture.

The basic concept of drip irrigation is that of slow, uniform application of water to the root zone. It is an attractive and practical concept that has been used with great success in agriculture for many years. This fact has actually been part of the problem in past attempts to adapt available supplies and concepts to the landscape. Many emitters designed for agricultural use were not pressure-compensating so discharge rates were not uniform on landscape projects with elevation changes. Recent developments have led to a proliferation of minisprinklers based on the same concept of slow, uniform application to the root zone, but they have expanded the point source delivery to a wetting area range that is more practical for landscape applications. New concepts in the placement and equipment configurations of drip and minisprinkler irrigation systems for commerical landscaping applications are reported. The uses of this equipment in the commercial landscape are bounded only by imagination. One can use bubblers or emitters for hanging baskets or special placnters and in whatever combination suits the need. They work well in high-traffic pedestrian areas, median strips and other areas where overspray and runoff are because their small size and flat spray copntrol distribution well. (Michael-PTT)
W87-02948

RECYCLING IRRIGATION RUNOFF ON CONTAINER ORNAMENTALS,
Monrovia Nursery Co., Azusa, CA.
C. A. Skimina.
Hortscience, Vol. 21, No. 1, p 32-34, February 1986. 1 fig, 5 tab, 3 ref.

Descriptors: *Recycling, *Runoff, *Irrigation, *Water reuse, *Ornamentals, Nurseries, *Water use efficiency, California, Plant growth, Suspended solids, Herbicides, Disinfection, Nutrients, Irrigation water, Horticulture, Hydrogen ion concentration, Salinity.

The possibility of recycling irrigation runoff for watering container grown ornamental plants was investigated as an alternative for meeting California's point discharge pollution control standards. Selected ornamental cultivars were studied to compare their growth and color under recycled water to those grown under noncycled, fresh fortified water. Overall mean growth increased by 106% for recycled water cultivars which may be attributed to an increase in nutrient elements. Runoff water can be recycled if suspended solids are first removed. Factors to be considered in runoff reuse include careful selection of herbicides, disinfection requirements and monitoring and control of pH and salinity. (Michael-PTT)
W87-02956

WATER CONSERVATION AND RECYCLING IN ORNAMENTALS PRODUCTION,
California Univ., Davis. Cooperative Extension.
R. F. Hasek, R. H. Sciaroni, and R. L. Branson.
Hortscience, Vol. 21, No. 1, p 35-38, February 1986. 6 fig, 1 ref.

Descriptors: *Water conservation, *Recycling, *Ornamentals, Nurseries, California, Planning, Runoff, Irrigation, Water use effiency, Irrigation water, Greenhouses.

Six case studies of water recycling and conservation by nurseries in the Half Moon Bay area of California are reported. Reductions in water use by growers were necessitated by rising water rates and demand pressures caused by local population growth. The case studies illustrate gains made in water use reductions by eliminating the washing down of greenhouse walks, precise measurement of water application to container grown plants and collecting and recycling nursery irrigation runoff. (Michael-PTT)
W87-02957

INTERACTIVE EFFECTS OF TRICKLE IRRIGATION RATES, CULTIVARS, AND CULTURE ON CUT CHRYSANTHEMUM,
Gulf Coast Research and Education Center, Bradenton, FL.
B. K. Harbaugh, C. D. Stanley, and J. F. Price.
Hortscience, Vol. 21, No. 1, p 94-95, February 1986. 2 tab, 4 ref.

Descriptors: *Trickle irrigation, *Flowers, *Water conservation, *Plant growth, *Water use efficiency, Flowering, Plant tissues, Horticulture, Cultivation, Irrigation requirements.

The need to conserve water in the United States and elsewhere has resulted in the development of several types of trickle irrigation systems for horticultural crops. These systems save a substantial quantity of water compared to traditional seep or overhead systems. Information on the relationships

of specific irrigation rates on the yield and quality of ornamental crops is scarce. The interactive effects of trickle irrigation rates, cultivars and culture on chrysanthemum flower yield and quality were studied. The minimum amount of water required to produce the greatest number of marketable, high quality flowers was estimated. Responses to irrigation rate were similar among culture and cultivar variables, but seasonal water use varied due to differences in cropping time as influenced by production method and choice of cultivars. (Michael-PTT)
W87-02959

ECOLOGICAL MODELLING, MONITORING AND IMPLEMENTATION IN IRRIGATED AGRICULTURE,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
G. V. Skogerboe.
Ecological Modelling, ECMODT Vol. 31, No. 1-4, p 45-59, May 1986. 35 ref.

Descriptors: *Plant growth models, *Ecological models, *Irrigation, *Agriculture, Salt transport, Soil erosion, Biocides, Irrigation equipment, Saturated flow, Unsaturated flow, Mathematical models, Design, Hydraulics.

Applications of modelling in irrigated agriculture are discussed, including plant growth simulation, salt transport, soil erosion, nutrient transport, transport of biocides, surface irrigation hydraulics, irrigation equipment development, surface irrigation design, and operation of surface irrigation systems. In irrigated agriculture, tremendous strides have been made during the past few decades in the capability of modelling subsurface flows, either saturated flow or unsaturated flow. The major pollutants are salts, sediments, nutrients, and pesticides, in order of priority, and the modelling capability fits this priority list. Until recently, design of surface irrigation systems was highly empirical and extremely poor in predicting actual hydraulic performance on a surface irrigated field. In the next few years, the design procedures will be vastly different as modelling is introduced. (Rochester-PTT)
W87-02966

CORN IRRIGATION SCHEDULING IN HUMID REGIONS ON SANDY SOILS WITH TILLAGE PANS,
North Carolina State Univ. at Raleigh. Dept. of Soil Science.
D. K. Cassel, C. K. Martin, and J. R. Lambert.
Agronomy Journal AGJOAT, Vol. 77, No. 6, p 851-855, November-December 1985. 3 fig, 4 tab, 15 ref.

Descriptors: *Irrigation practices, *Hydrologic budget models, *Crop yield, *Irrigation effects, *Tillage pans, *Corn, *Humid areas, *Sandy soils, Hydrologic budge., Computers, Tensiometers, Cultivation, Farming.

The effect of supplemental irrigation in a humid environment on corn production on an Atlantic Coastal Plain soil with tillage pan was studied and two alternative techniques for scheduling supplemental irrigation in humid regions were evaluated. The study used a split plot design with irrigation scheduling as the main block. Scheduled irrigation applications were based on a computerized water balance model and scheduled water applications were based on tensiometer measurements. Subplot treatments were based on the time of nitrogen application and cultivation intensity. The average amount of irrigation water applied over the three-year period based on the water balance model was 40 millimeters greater than the three-year average rainfall amounts derived from tensiometer measurements. Grain yield as affected by subplot treatment was not significantly different for any year. Either irrigation scheduling method offered larger yield improvements in drier years, and there was no significant yeild difference between the two techniques. (Michael-PTT)
W87-02981

RESPONSES OF SUGARBEET TO DEFICIT, HIGH-FREQUENCY SPRINKLER IRRIGATION. I. SUCROSE ACCUMULATION, AND TOP AND ROOT DRY MATTER PRODUCTION,
Washington State Univ., Pullman.
A. N. Hang, and D. E. Miller.
Agronomy Journal AGJOAT, Vol. 78, No. 1, p 10-14, January-February 1986. 4 fig, 1 tab, 9 ref.

Descriptors: *Beets, *Sprinkler irrigation, *Sucrose, *Roots, Loam, Sandy soils, Evapotranspiration, Crop yield, Plant growth, Accumulation, Irrigation effects, Irrigation requirements.

The effect of deficit daily sprinkler irrigation on sucrose accumulation and root and top dry matter production in sugarbeets grwon in loam and sandy soils was studied. Applied water ranged from 15 to 100% and from 26 to 115% of estimated evapotranspiration after nearly full canopy on both soil types. Root sucrose increased rapidly with time on the loam soil, but the rate of increase was lower with adequate soil water than when it was limited. At final harvest, maximum dry matter production occurred at irrigation rates equivalent to 40 to 50% of evapotranspiration. On sandy soil with limited water, root sucrose concentrations increased to a maximum after eight weeks of irrigation treatment and then decreased. Sucrose concentrations increased until harvest with adequate water on sandy soil. Sucrose concentration was higher with limited than adequate water until near harvest. Dry matter production increased with increasing water applied up to about 85% of estimated evapotranspiration. (See also W87-02986) (Michael-PTT)
W87-02985

RESPONSES OF SUGARBEET TO DEFICIT, HIGH-FREQUENCY SPRINKLER IRRIGATION. II. SUGARBEET DEVELOPMENT AND PARTITIONING TO ROOT GROWTH,
Washington State Univ., Pullman.
A. N. Hang, and D. E. Miller.
Agronomy Journal AGJOAT, Vol. 78, No. 1, p 15-18, January-February 1986. 3 fig, 1 tab, 11 ref.

Descriptors: *Beets, *Sprinkler irrigation, *Roots, *Plant growth, Loam, Sandy soils, Evapotranspiration, Irrigation effects, Irrigation requirements, Leaves.

The effect of deficit daily irrigation on rates and growth characteristics of sugarbeets grown in loam and sandy soils was studied. On loam soil, irrigation rates that were less than estimated evapotranspiration did not affect leaf/blade petitole or top/root ratio until four to eight weeks after irrigation. Afternoon wilting at various irrigation rates was observed, but turgor was regained during the night. After eight weeks of irrigation at 15 and 17% of evapotranspiration, specific leaf weight increased significantly. Top and root growth increased as water application increased. Partitioning to root growth maximized at irrigation rates of 58% of estimated evapotranspiration. Irrigation rates less than evapotranspiration depressed growth and shortened leaf life cycle on sandy soil. Leaf blade petitole and top/root ratio were not affected until after six weeks of deficit irrigation. Low irrigation rates depressed leaf expansion and caused high specific leaf weights. Top and root growth rates increased and partitioning to root growth maximized with water application up to 100% of evapotranspiration. Increasing irrigation to 115% gave no increased growth benefits. Leaf/blade petitole and top/root ratios were generally affected later and less by drought than were leaf area, specific leaf weight and crop growth rate in both types of soils. (See also W87-02985) (Michael-PTT)
W87-02986

MANAGEMENT OF SORGHUM UNDER LIMITED IRRIGATION,
Agricultural Research Service, Bushland, TX.
D. J. Undersander.
Agronomy Journal AGJOAT, Vol. 78, No. 1, p 28-32, January-February 1986. 3 fig, 4 tab, 12 ref.

Descriptors: *Sorghum, *Irrigation practices, Irrigation efficiency, Seeding practices, Rainfall, Runoff, Furrow irrigation, Water use efficiency.

Research was conducted on graded furrows to compare different systems for irrigation of sorghum that maximize the use of rainfall. The treatment receiving 2.5 cm of water was irrigated only in every third furrow and that receiving 3.8 cm was irrigated in alternate furrows. Total water applied varied with years due to rainfall. Seeding rate was varied down the row on plots that received different water treatments. A variable seeding rate was compared with uniform seeding on the 3.8 cm water treatment and every third row was left blank on the 2.5 cm treatment. Limited irrigation reduced runoff compared with full irrigation and water advanced farther down the field in alternate than in furrow irrigation. The dams of non-irrigation furrows were left in better condition to retain rainwater than those in irrigated furrows. Irrigation water use efficiency of the 3.8 cm treatment was higher than that of 5.1 cm applied to every furrow with no change in yield. Yield and water use efficiencies from plots with a uniform rate of seeding were equal to those from variably seeded plots. (Michael-PTT)
W87-02987

KLEINGRASS YIELD AND QUALITY UNDER THREE IRRIGATION REGIMES WHEN HARVESTED AT ANTHESIS,
New Mexico State Univ., Las Cruces. Dept. of Crop and Soil Sciences.
R. P. Clark, and D. G. Lugg.
Agronomy Journal AGJOAT, Vol. 78, No. 2, p 235-239, March-April 1986. 1 fig, 2 tab, 19 ref.

Descriptors: *Forages, *Crop yield, *Irrigation practices, *Water stress, *Anthesis, *Forage yield, Calcium, Magnesium, Nitrogen, Phosphorus, Leaves, Plant tissues, Soil water, Dry matter.

Kleingrass was irrigated at two, three and five week intervals during two growing seasons on a mixed calcareous soil to determine the effect of different irrigation regimes on dry forage yield and forage quality. Dry forage yields, in vitro dry matter disappearance (IVDMD) and Ca, Mg, N and P concentrations were measured in forage harvested at anthesis. Significant negative relationships were found between the amount of irrigation water applied, dry forage yield, Ca and Mg concentrations and IVDMD. No relationships were found between the amount of irrigation water applied, dry forage yield or N or P concentrations. Ca and Mg concentrations and IVDMD were higher with lower soil moisture contents, possibly due to higher leaf to stem weight ratios in the lower-yielding, water stressed kleingrass. (Michael-PTT)
W87-02993

IRRIGATION EFFECTS ON AGRONOMIC CHARACTERS OF MEADOWFOAM,
Colorado State Univ., Grand Junction. Fruita Research Center.
C. H. Pearson, and G. D. Jolliff.
Agronomy Journal AGJOAT, Vol. 78, No. 2, p 301-304, March-April 1986. 2 fig, 3 tab, 14 ref.

Descriptors: *Meadowfoam, *Irrigation effects, *Oilseed crops, Crop yield, Seeds, Plant growth, Honey bees, Flowering, Climates, Irrigation requirements.

The effects of irrigation on oil yield, seed yield and components, plant growth and development, and honey bee foraging were determined for meadowfoam, an oilseed crop developed for Mediterranean climates. Irrigation treatments included early irrigation during flowering and continued irrigation until maturity. Seed yield was not increased with irrigation due to above-average rainfall that year, but seed yield with irrigation increased by 32% the following year. Seed yield differences between early and continued irrigation treatments were not significant. Seeds per flower and 1000-seed weights were higher for the irrigated treatments than the non-irrigated control. Bee foraging was greater

under irrigation which may have accounted for more seeds per flower. Seed oil content in the irrigated treatments was significantly lower than in the control, but irrigated treatments yielded 29% more total oil than the control. Irrigated plants were taller, and in one year produced more dry matter and had smaller canopy light transmittance. Meadowfoam can be successfully grown in Mediterranean climates without irrigation during some years, but in others, irrigation during flowering and seed development may be required to achieve high seed and oil yields. (Michael-PTT)
W87-02995

YIELD AND PHYSIOLOGICAL RESPONSES OF POTATOES TO DEFICIT, HIGH FREQUENCY SPRINKLER IRRIGATION,
A. N. Hang, and D. E. Miller.
Agronomy Journal AGJOAT, Vol. 78, No. 3, p 436-440, May-June 1986. 6 fig, 2 tab, 10 ref.

Descriptors: *Sprinkler irrigation, *Potatoes, *Plant physiology, *Water stress, *Plant growth, *Evapotranspiration, Leaves, Roots, Irrigation requirements, Irrigation practices, Sandy soils, Crop yield.

The effects of irrigation rate on potato crop performance were determined. Irrigation treatments were initiated at full canopy on a sandy soil using the line source technique. Daily sprinkler irrigation near the line source was equal to 1.15 times the estimated evapotranspiration. Water stress symptoms were first observed two weeks after treatment in plants receiving the least amounts of irrigation water. Symptoms included reduced plant size, fewer and more dead leaves and increased specific leaf weight as compared to nonstressed plants. Tuber and top growth rates increased with increasing irrigation. Partitioning of assimilate to tuber growth decreased with increasing irrigation. Results indicate that potatoes grown on sandy soil need irrigation at rates approaching estimated evapotranspiration to avoid reductions in yield and quantity. Increasing irrigation beyond 100% of evapotranspiration did not increase yields. (Michael-PTT)
W87-02997

ESTIMATION OF SPRING WHEAT SPIKE WATER CONCENTRATION AND GRAIN MATURITY FROM AIR TEMPERATURE,
Science and Education Administration, Mandan, ND. Northern Great Plains Research Center.
For primary bibliographic entry see Field 2I.
W87-02998

COMPARISON OF SPRINKLER AND FLOOD IRRIGATION FOR RICE,
M. P. Westcott, and K. W. Vines.
Agronomy Journal, AGJOAT Vol. 78, No. 4, p 637-640, July-August 1986. 6 tab, 9 ref.

Descriptors: *Irrigation efficiency, *Rice, *Sprinkler irrigation, *Flood irrigation, Clays, Soil water, Plant diseases, *Crop yield, Nitrogen, Regression analysis, Fungicides, Nutrients, Plant tissue.

Sprinkler irrigation of rice (Oryza sativa L.) has recently been considered to reduce water use and increase grower flexibility in U. S. production areas where flood irrigation is predominant. Tests were conducted to determine the relative effectiveness of sprinkler vs. flood irrigation for rice cultivation under clay soil conditions. Irrigation methods were main plots and three cultivars in one year and six cultivars in the following year were subplots which were treated with single or split applications of nitrogen. Sprinkler irrigation consisted of three weekly applications to maintain soil moisture tension. In the first year, spinkler irrigation increased sheath blight incidence and decreased grain yield, dry matter production, harvest index and florets per panicle as compared to flood irrigation. Despite chemical control of sheath blight, sprinkler irrigated rice yielded less than flood irrigated crops the following year. Nitrogen timing did not significantly affect yields, but a weak nitrogen timing combined with irrigation method interaction denoted that split nitrogen applications may benefit yields under sprinkler irrigation. Multiple regression indicated that fewer florets per panicle was the cause of yield loss with sprinkler irrigation. Sprinkler irrigation of rice might decrease water use, but it lowers crop yields and increases the need for fungicides as compared with flood irrigation. (Michael-PTT)
W87-03004

RESPONSE OF CORN TO TILLAGE AND DELAYED IRRIGATION,
North Carolina State Univ. at Raleigh. Dept. of Soil Science.
For primary bibliographic entry see Field 2I.
W87-03007

SOILS INFLUENCE IRRIGATION,
LESCO, Inc., Rocky River, OH.
For primary bibliographic entry see Field 2G.
W87-03020

EVALUATION OF EFFLUENT FROM GRASS SILAGE AS A FEED FOR BEEF CATTLE OFFERED SILAGE-BASED DIETS,
Agricultural Research Inst. of Northern Ireland, Hillsborough.
For primary bibliographic entry see Field 5E.
W87-03099

IRRIGATION SCHEDULING EFFECTS ON CONTAINER MEDIA AND CANOPY TEMPERATURES AND GROWTH OF 'HERSHEY'S RED' AZALEA,
Auburn Univ., AL. Dept. of Horticulture.
G. J. Keever, and G. S. Cobb.
Hortscience HJHSAR, Vol. 20, No. 5, p 921-923, October 1985. 1 fig, 2 tab, 12 ref.

Descriptors: *Overhead irrigation, *Irrigation scheduling, *Azaleas, *Temperature effects, Plant growth, Canopy temperature, Intermittent irrigation, Plant physiology.

Overhead irrigation during the day reduces maximum temperatures and their duration within the plant canopy and the container growth medium, and resulted in increased top and root growth of 'Hershey's Red' azalea (Rhododendron X 'Hershey's Red'). Intermittent irrigation for 2.5 min/hr during the day reduced canopy temperature but did not affect growth medium temperature or plant growth. (Author's abstract)
W87-03103

EFFECT OF WOVEN PLASTIC MULCH, HERBICIDES, GRASS SOD, AND NITROGEN ON 'FOCH' GRAPES UNDER IRRIGATION,
Department of Agriculture, Summerland (British Columbia). Research Station.
D. S. Stevenson, G. H. Neilsen, and A. Cornelsen.
Hortscience HJHSAR, Vol. 21, No. 31, p 439-441, June 1986. 2 tab, 15 ref.

Descriptors: *Woven plastic mulch, *Herbicides, *Grass sod, *Nitrogen, *Grapes, *Irrigation, Soil treatments, Glyphosate, Fertilizer, Plant physiology, Vine crop, Crop yields, Cost analysis, Cultivation.

Three soil surface treatments were compared for grape production. Plastic mulch was superior to glyphosate and to grass sod in producing yields during the first 2 yr of production. By the 3rd yr, the glyphosate treatment was equal to the plastic and both were superior to grass sod. Cluster weights and pruning weights were suppressed by grass sod, compared with plastic or herbicide, but were unaffected by N. N fertilizer treatments had no measurable effects on the grapevines and showed no interaction with the soil surface treatments. None of the treatments (soil surface or fertilizer) had any effect on berry soluble solids. The use of plastic mulch is an effective cultural technique, the usefulness of which will depend mostly on cost and environmental comparisons with herbicides. (Author's abstract)
W87-03106

NURSERY IRRIGATION-SYRINGE SYSTEM THAT MONITORS ENVIRONMENTAL PARAMETERS,
Texas A and M Univ., College Station. Dept. of Physics.
For primary bibliographic entry see Field 7C.
W87-03107

MUSKMELON GROWTH, YIELD, AND NUTRITION AS INFLUENCED BY PLANTING METHOD AND TRICKLE IRRIGATION,
Agricultural Research Service, Charleston, S.C. Vegetable Lab.
H. S. Bhella.
Journal of the American Society for Horticultural Science JOSHB5, Vol. 110, No. 6, p 793-796, November 1985. 3 tab, 24 ref.

Descriptors: *Muskmelons, *Trickle irrigation, *Direct seeding, *Transplanting, *Plant growth, *Plant nutrition, *Crop yield, Plant physiology, Indiana, Plastic mulch, Root development, Leaf growth, Petiole mineral concentration, Taproots, Geotropism, Soluble solids, Manganese, Iron, Sodium, Correlations, Field tests, Tissue analysis.

Responses of muskemelon (Cucumis melo L. 'Classic') root development, stem and leaf growth, petiole mineral concentration, and yield to trickle irrigation and planting method (direct-seeded vs. transplanted) were evaluated. Field studies were conducted on a southwestern Indiana Lyles silt loam or fine sandy loam soil during two successive years, using black plastic mulch. Trickle irrigation decreased depth of penetration of roots compared with no irrigation. Trickle irrigation significantly increased the stem length and diameter, leaf area, mean fruit weight and yield, but decreased soluble solids in fruit. Direct-seeded muskmelon plants produced deep taproots exhibiting positive geotropism, whereas transplants produced more extensive lateral, plagiotropic, or geotropically-insensitive roots. Direct-seeded muskmelons had significantly larger stem length and diameter, leaf area, soluble solids, and petiole Mn concentration, and lower petiole Fe and Na concentration than transplants. Significant correlations were established between various components of muskmelon growth and development. (Author's abstract)
W87-03108

NITROGEN SOURCE AND APPLICATION TIMING FOR TRICKLE IRRIGATED STRAWBERRIES,
Agricultural Research and Education Center, Lake Alfred, FL.
S. J. Locascio, and F. G. Martin.
Journal of the American Society for Horticultural Science JOSHB5, Vol. 110, No. 6, p 820-823, November 1985. 5 tab, 9 ref.

Descriptors: *Strawberries, *Trickle irrigation, *Nitrogen sources, *Fertilizer, *Crop yield, Plant physiology, Plant nutrition, Nitrogen, Potassium, Sulfur-coated urea, Isobutylidene diurea, Ammonium nitrate, Potassium nitrate, Calcium nitrate, Leaf tissue.

Strawberries (Fragaria X ananassa Dutch.) were grown during two seasons to evaluate five N sources and two times of N and K application using trickle irrigation, with N and K rates of 134 and 149 kg/ha, respectively. Fruit yields were influenced by significant interactions between N source and time of N and K application during both seasons. With 100% of the N and K applied preplant, marketable fruit number and weight were significantly greater with sulfur-coated urea (SCU) or isobutylidene diurea (IBDU) than with urea, NH4NO3, or KNO3 + Ca(NO3)2 as the N sources. With 40% of the N from the above sources applied preplant and 60% of the N and K supplied with the trickle irrigation from NH4NO3 + K2SO4 or KNO3 + Ca(NO3)2, production was similar with all N sources. Leaf tissue N and K concentrations were not influenced consistently by N source. During both seasons, leaf N concentrations were higher with the split than with the 100% preplant treatments. (Author's abstract)
W87-03109

SEASONAL RESPONSE OF 'ANJOU' PEAR TREES TO DIFFERENT IRRIGATION REGIMES. I. SOIL MOISTURE, WATER RELATIONS, TREE AND FRUIT GROWTH,
Washington State Univ., Wenatchee. Tree Fruit Research Center.
C. A. Brun, J. T. Raese, and E. A. Stahly.
Journal of the American Society for Horticultural Science JOSHB5, Vol. 110, No. 6, p 830-834, November 1985. 6 fig, 2 tab, 21 ref.

Descriptors: *Pears, *Irrigation, *Soil water, *Plant water potential, *Arid climate, *Crop yield, Stomatal conductance, Seasonal variations, Leaf water potential, Transpiration, Terminal buds, Plant physiology, Fruit weight, Evaporation.

Mature bearing pear (Pyrus communis L. 'Beurre d'Anjou') trees in an arid climate were irrigated weekly at 125% of pan evaporation (wet), biweekly at 100% of pan evaporation (normal), or irrigated only twice (dry) during the summer (1980, 1981), and were fertilized with and without 0.9 kg of supplemental N. Prior to final fruit harvest in 1981, depletion of available soil moisture (ASM) averaged 10, 16.7, and 89% for the wet, normal, and dry treatments, respectively. Mid-day leaf water potential (Psi sub L) was correlated with the level of ASM only on bright days of high vapor pressure deficit. Stomatal conductance and transpirational flux density of dry treatment leaves were lower than that of either wet or normal treatment leaves; Psi sub L exceeded -1.4 to -1.7 MPa. Resistance to vapor (water) transport of fruit was independent of irrigation regime. Terminal buds had set on shoots from all three irrigation regimes a 58 days after full bloom (AFB) in 1981, but resumed growth on normal and wet treatment shoots at 87 days AFB. On 7/10 sampling dates during 1981, dry treatment fruit weighed less than normal or wet treatment fruit. (See also W87-03111) (Author's abstract)
W87-03110

SEASONAL RESPONSE OF 'ANJOU' PEAR TREES TO DIFFERENT IRRIGATION REGIMES. II. MINERAL COMPOSITION OF FRUIT AND LEAVES, FRUIT DISORDERS, AND FRUIT SET,
Washington State Univ., Wenatchee. Tree Fruit Research Center.
C. A. Brun, J. T. Rase, and E. A. Stahly.
Journal of the American Society for Horticultural Science JOSHB5, Vol. 110, No. 6, p 835-840, November 1985. 3 fig, 6 tab, 27 ref.

Descriptors: *Pan evaporation, *Pears, *Fruit quality, *Irrigation, *Potassium, *Magnesium, *Calcium, *Nitrogen, *Alfalfa greening, *Cork spot, Plant pathology, Plant growth, Plant physiology, Boron, Iron, Manganese, Zinc, Correlations, Bloom density, Flowering, Plant reproduction, Tissue analysis.

Mature bearing pear trees were irrigated weekly at 125% of pan evaporation (wet), biweekly at 100% of pan evaporation (normal), or only twice (dry) during the summers of 1980 and 1981. Fruit Ca concentration of dry treatment fruit generally was greater than the concentration in normal or wet treatment fruit. Although irrigation treatment did not consistently alter fruit K or Mg concentration, the K/Ca ratio of normal or wet treatment fruit typically was greater than that for dry treatment fruit. Dry treatment fruit had the lowest concentrations of peel and flesh N from 42-144 days after full bloom in 1981, resulting in lower N/Ca ratios than normal or wet treatment fruit. Fruit from the lower half of tree canopies had a greater Ca concentration, resulting in lower N/Ca and K/Ca ratios than in fruit from the upper canopy positions. The lowest incidence of fruit disorders (alfalfa greening and cork spot) occurred in the dry treatment trees. Fruit disorders, especially cork spot, were positively correlated with increased irrigation, shoot growth, fruit N and K concentrations, fruit N/Ca and K/Ca ratios, and early (1 May 1981) levels of fruit B, Fe, Mn, and Zn, but negatively correlated to Ca. Although there was no significant effect of irrigation treatment on bloom density in 1981, fruit set was reduced in trees subjected to the dry irrigation regime. (See also W87-03110) (Author's abstract)
W87-03111

SEASONAL GROWTH AND COMPOSITION AND ACCUMULATION OF N-P-K IN DRYLAND AND IRRIGATED PUMPKINS,
Illinois Univ. at Urbana-Champaign. Dept. of Horticulture.
For primary bibliographic entry see Field 2I.
W87-03150

WATER DEFICIT DURING PANICLE DEVELOPMENT IN PEARL MILLET: YIELD COMPENSATION BY TILLERS,
International Crops Research Inst. for the Semi-Arid Tropics, Patancheru (India).
For primary bibliographic entry see Field 2I.
W87-03157

DEPARTMENT OF AGRICULTURE, BELFAST (N. IRELAND). AGRICULTURAL AND FOOD CHEMISTRY RESEARCH DIV.
Agriculture and Food Science Centre, Belfast (Northern Ireland). Agricultural and Food Chemistry Research Div.
C. J. Watson, and S. N. Adams.
The Journal of Agricultural Science JASIAB, Vol. 107, No. 1, p 219-222, August 1986. 4 tab, 10 ref.

Descriptors: *Wet spring conditions, *Nitrogen fertilizers, *Italian ryegrass, *Simulated rainfall, Irrigation, Crop yield, Phosphorus, Potassium, Sodium, Magnesium, Herbage, Ammonium sulfate, Calcium nitrate, Ammonium nitrate, Plant growth, Plant physiology.

Irrigation was employed to simulate a wet spring season, while other conditions were kept the same for all treatments in which N in different forms was applied to Italian ryegrass cv. RVP. N was applied as (NH4)2SO4, 5Ca(NO3)2-NH4NO3.10H20, or urea in the presence and the absence of the watering treatment (92 mm of irrigation added to natural rainfall of 172 mm). On average, irrigation signficantly reduced, and all N fertilizers significantly increased, both yield and N uptake. When no irrigation was applied there was little difference between N forms in either yield or N uptake observed at first cut. With irrigation, however, NO3-N resulted in a signficantly lower dry matter yield and N uptake compared to ammonium sulfate or urea N. The irrigation treatment slightly lowered the percentage of P, K, Na, and Mg in the herbage at first cut. At the second cut there was no significant difference between the effects of the form of N or watering regime on dry matter yield or N uptake. The present results support the proposal that, under high rainfall conditions, early spring N should be applied in the NH4(+) form rather than the NO3(-) form to obtain more efficient utilization and increased dry matter yield. (Rochester-PTT)
W87-03159

MECHANIZED TILLAGE SYSTEMS EFFECTS ON PROPERTIES OF A TROPICAL ALFISOL IN WATERSHEDS CROPPED TO MAIZE,
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
For primary bibliographic entry see Field 2G.
W87-03162

COMPACTION AND TILLAGE DEPTH COMBINATIONS FOR WATER MANAGEMENT AND RICE PRODUCTION IN LOW-RETENTIVE PERMEABLE SOILS,
Indian Inst. of Tech., Kharagpur. Dept. of Agricultural Engineering.
S. Kar, R. P. Samui, J. Prasad, C. P. Gupta, and T. K. Subramanyam.
Soil and Tillage Research SOTRD5, Vol. 6, No. 3, p 211-222, February 1986. 2 fig, 7 tab, 7 ref.

Descriptors: *Soil compaction, *Tillage depth, *Rice, *Crop yield, *Soil permeability, Bulk density, Infiltration rate, Surface water retention, Upland rice, Lowland rice, Puddling, Wedge plow, Power tiller.

Artificially compacted surface and subsurface layers were induced in soil by suitably combining level of compaction obtained by one (D1), two (D2), four (D3), or six (D4) passes of an iron roller at a load intensity of 0.21 kg/sq cm and post-compaction tillage or puddling depth of 0 cm (T0), 5 cm (T1), 10 cm (T2), or 15 cm (T3). An additional no-compaction treatment (D0) was included in lowland experiments. Rice yield was increased significantly on upland by artificially compacting the soil to D2. However, with compaction to D3 and D4, the yield decreased. When post-compaction tillage was adopted, the grain yield decreased at low compaction level (D1, D2) but increased at high compaction level (D3, D4) with increase in tillage depth form 0 to 15 cm. The maximum grain yield occurred at D3T1. Higher grain yield at D3T1, D2T1, and D4T2 is attributable to a more favorable soil bulk density profile, a lower infiltration rate, and higher surface retention of water. The efficiency of applied N fertilizer apparently was increased at these compaction-tillage depth combinations, where the upland rice yield experienced insignificant reduction with decrease in N applicatin rate from 100 to 60 kg/ha. Similar trends of yield response to compaction-tillage combinations were observed under lowland conditions. When the soil was puddled (following high compaction) with a wedge plow or a power tiller, rice yields were increased by 48 to 56%, respectively, over yields using conventional puddling (without compaction). The yield increased further with the increase in intensity of puddling using a power tiller. (Rochester-PTT)
W87-03163

EFFECTS OF TILLAGE METHODS AND WATER REGIMES ON SOIL PROPERTIES AND YIELD OF LOWLAND RICE FROM A SANDY LOAM SOIL IN SOUTHWEST NIGERIA,
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
For primary bibliographic entry see Field 2I.
W87-03164

EFFECT OF DEEP TILLAGE AND CONTROLLED TRAFFIC ON ROOT GROWTH, WATER-USE EFFICIENCY AND YIELD OF IRRIGATED MAIZE AND WHEAT,
Orange Free State Univ., Bloemfontein (South Africa). Dept. of Soil Science.
A. T. P. Bennie, and F. J. P. Botha.
Soil and Tillage Research SOTRD5, Vol. 7, No. 1/2, p 85-95, May 1986. 4 fig, 2 tab, 22 ref.

Descriptors: *Deep tillage, *Controlled traffic, *Agricultural machinery, *Corn, *Wheat, *Crop yield, *Water-use efficiency, *Irrigation, Deep ripping, Root growth, Plant physiology, Plant growth, Field tests.

Field trials were conducted under irrigation in an arid climate to compare the conventional tillage practice with two controlled-wheel-traffic practices, each consisting of deep ribbing of the subsoil followed by control of wheel traffic to specific lanes during seedbed preparation. In one deep tillage treatment, the traffic lanes were kept intact and in the other treatment the traffic lanes were loosened during the last cultivation to create favorable conditions for maximum root growth. Deep ripping and controlled traffic led to a significnant increase in rooting depth, rooting density in the subsoil, water use efficiency, and a yield increase of 30% for maize and 19% for wheat. Subsequent loosening of the traffic lanes decreased the positive yield effect of ripping by 4%. (Author's abstract)
W87-03165

EFFECT OF TILLAGE AND MULCHING ON SOIL ENVIRONMENT AND COWPEA SEEDLING GROWTH UNDER ARID CONDITIONS,
Central Arid Zone Research Inst., Jodhpur (India). Div. of Soil-Water-Plant Relationship Studies.
J. P. Gupta, and G. K. Gupta.
Soil and Tillage Research SOTRD5, Vol. 7, No. 3, p 233-240, June 1986. 2 fig, 2 tab, 18 ref.

Descriptors: *Mulching, *Tillage, *Cowpeas, *Arid conditions, *Disk harrowing, *Charcoal rot, *Dry root rot, *Farm management, *Crop yield, *Soil temperature, Seedling emergence, Plant growth, Plant physiology, Soil environment, Plant pathology.

The effect of tillage and mulching on the soil environment and cowpea (Vigna unguiculata cv. FS-68) seedling growth under arid conditions was studied. One disking and three diskings with a disc harrow up to 15-cm depth improved the soil environment and increased the final seedling emergence count, but did not affect the population of Macrophomina phaseolina (charcoal rot or dry root rot) in the soil. Disking also increased plant growth and markedly reduced seedling mortality. Placement of weed mulch between the crop rows at a rate of 6 t/ha along with disking treatments signficantly increased the mean moisture status of the 15-cm soil depth by 1.4% on a dry weight basis, significantly decreased the mean maximum temperature of the 10-cm depth (measured at 2 PM) by 3.9 C and thus increased plant growth and dry matter production. Mulching also markedly reduced the population of M. phaseolina and the mortality of the cowpea seedlings. (Author's abstract)
W87-03166

RESPONSE OF CONSERVATION TILLAGE SORGHUM TO GROWING SEASON PRECIPITATION,
Agricultural Research Service, Bushland, TX. Conservation and Production Lab.
P. W. Unger, J. L. Steiner, and O. R. Jones.
Soil and Tillage Research SOTRD5, Vol. 7, No. 4, p. 291-300, August 1986. 2 fig, 2 tab, 26 ref.

Descriptors: *Sorghum, *Conservation tillage, *Growing season, *Rainfall, *Crop residue, *Crop yields, Regression analysis, Plant growth, Plant physiology, Litter.

Previous results had suggested that sorghum responded positively to growing season precipitation when increasing amounts of residue remained on the soil during the growing season. The present investigation attempted to evaluate this response to growing season precipitation through statistical analyses of data from five earlier tillage and residue placement studies. Regression analyses showed that sorghum grain yields increased with increasing amounts of surface residues at planting time. Differences in response of grain yield to precipitation were greatest in the vegetative period. For that period, grain yields increased 0.014 megagram (Mg)/ha per mm of precipitation when residue amounts ranged from 0 to 0.4 Mg/ha and 0.027 Mg/ha per mm of precipitation when residue amounts were >3.2 Mg/ha. Differences in response to rainfall in the heading and grain filling period were lower or negligible. (Rochester-PTT)
W87-03167

EVAPORATION AND REDISTRIBUTION OF SALTS IN A SILT LOAM SOIL AS AFFECTED BY TILLAGE INDUCED SOIL MULCH,
Central Soil Salinity Research Inst., Karnal (India).
P. S. Minhas, B. K. Khosla, and S. S. Prihar.
Soil and Tillage Research SOTRD5, Vol. 7, No. 4, p 301-313, August 1986. 9 fig, 2 tab, 30 ref.

Descriptors: *Evaporation, *Soil water, *Soil salinity, *Permeability coefficient, *No-tillage management, *Mulch, Unsaturated zone, Salinization.

Soil water evaporation, redistribution of surface applied salts and unsaturated hydraulic conductivity were determined in field plots of a silt loam soil kept either untilled or tilled to a depth of 5 cm 2-3 days folowing irrigation. The hydraulic gradients measured were comparatively steeper and the zone of zero flux during drying occurred at greater depths in untilled than tilled soil. Tillage-induced soil mulch reduced evaporation losses, but its effectiveness decreased during high external evaporative demand conditions. Due to reduction in upward movement of water, shallow tillage resulted in decreased upward movement of salts and thus, increased efficiency of leaching during intermittent ponding. Empirical relationships describing the leaching process showed a net saving of 12.7% in water required to attain 70% removal of surface accumulated salts. Increase in unsaturated hydraulic conductivity of soil due to salinization was observed. (Rochester-PTT)
W87-03168

EFFECT OF SUBSOILING AND IRRIGATION ON POTATO PRODUCTION,
New Zealand Soil Bureau, Lower Hutt.
C. W. Ross.
Soil and Tillage Research SOTRD5, Vol. 7, No. 4, p 315-325, August 1986. 5 fig, 1 tab, 20 ref, append.

Descriptors: *Subsoiling, *Irrigation, *Potatoes yield, *Fertilizers, Deep chiseling, Washington, Columbia basin, Subsoil physical conditions, Cubic polynomial regressions, Root system, Drought, Plant water relations, Plant physiology.

Deep chiseling between potato rows, with simultaneous incorporation of fertilizer, was used to break up thin tillage pans in silty-textured soils in the Columbia Basin of Washington State, enabling deeper root development. The effects of subsoiling on physical conditions and on potato production were examined under varying rates of irrigation. Deep tillage decreased soil strengths and bulk densities and increased porosity to depths of 10-16 cm below the pans. These improved subsoil physical conditions resulted in deeper root penetration, but the additional rooting only amounted of a small increase in the total root system. Cubic polynomial regressions demonstrated that subsoiling significantly increased potato yields under very droughty conditions but had no significant effects at intermediate (near optimum) levels of water application. Potato quality (percentage of U.S. No. 1 grade tubers and tuber specific gravity) was generally unaffected by deep tillage. (Author's abstract)
W87-03169

EFFECTS OF IN-ROW AND INTERROW SUBSOILING AND TIME OF NITROGEN APPLICATION ON GROWTH, STOMATAL CONDUCTANCE AND YIELD OF STRIP-TILLED CORN,
Alabama Agricultural Experiment Station, Auburn.
D. W. Reeves, and J. T. Touchton.
Soil and Tillage Research, Vol. 7, No. 4, p 327-340, August 1986. 5 fig, 5 tab, 17 ref.

Descriptors: *Strip-tillage, *Irrigation, *Corn, *Subsoiling, Nitrogen fertilizers, *Crop yield, *Plant growth, *Stomatal conductance, Plant physiology, Plant water relations, Continuous cultivation.

Corn was strip-till planted and grown under irrigation for 2 yr at one location and 1 yr at another location to study the effects of subsoiling and placement and timing of N application (157 kg/ha) on plant growth, stomatal conductance, and yield. N applied 5 wk after planting resulted in higher yields than when applied at planting. In-row subsoiling at planting, interrow subsoiling 5 wk after planting, and subsoiling in-row at planting plus interrow 5 wk later resulted in increased stomatal conductance between irrigations. Delaying N application resulted in decreased stomatal conductance in treatments that were in-row subsoiled at planting. Grain yields were lower without than with subsoiling, especially when N was applied at planting. When water was not limiting, subsoiling interrow 5 wk after planting was as effective in increasing grain yield as in-row subsoiling at planting. In one test, the highest grain yield (9.96 t/ha) resulted from the cumulative effect of subsoiling in-row at planting plus interrow 5 wk later. (Rochester-PTT)
W87-03170

PHYSICAL ENVIRONMENT NEAR THE SURFACE OF PLOWED AND NO-TILLED SOILS,
Science and Education Administration, Lincoln, NE
For primary bibliographic entry see Field 2G.
W87-03171

PRODUCTION FUNCTION FOR COTTON WITH DATED IRRIGATION QUANTITIES AND QUALITIES,
California Univ., Riverside.
A. Dinar, K. C. Knapp, and J. D. Rhoades.
Water Resources Research WRERAQ, Vol. 22, No. 11, p 1519-1525, October 1986. 5 fig, 6 tab, 27 ref.

Descriptors: *Crop water, *Irrigation practices, *Irrigation water, *Impaired water use, Cotton, Saline water, Evapotranspiration, Soil water, Soil salinity, Model studies.

A dynamic crop-water production function model is estimated for cotton. Evapotranspiration (ET) depends on soil moisture and soil salinity which in turn depend on irrigation volumes and qualities. Crop yield is a function of ET. A maximum likelihood approach is developed for estimating the ET function when moisture and ET observations are not available on a daily basis. The estimated ET function varies by crop growth stage and generally shows decreasing ET as soil water potential decreases. Soil salinities following irrigation are explained quite well using a piston flow model of salt transport. Several yield-ET relations are estimated. The model can be used for predicting crop yield, ending soil salinity and soil moisture levels, and drainage volumes and qualities, given irrigation timing, quantity and quality of applied water, and initial levels of soil salinity and soil moisture. (Author's abstract)
W87-03189

TRANSPORT OF CONSERVATIVE TRACERS IN THE FIELD UNDER INTERMITTENT FLOOD IRRIGATION,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
For primary bibliographic entry see Field 2G.
W87-03191

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

ENVIRONMENTAL DESIGNS FOR STREAMBANK PROTECTION PROJECTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
For primary bibliographic entry see Field 6G.
W87-02621

COMPARISON OF MOBED AND HEC-6 RIVER FLOW MODELS,
National Water Research Inst., Burlington (Ontario). Environmental Hydraulics Section.
For primary bibliographic entry see Field 2E.
W87-02669

DESIGNING FOR DYNAMIC EQUILIBRIUM IN STREAMS,
Rocky Mountain Forest and Range Experiment Station, Tempe, AZ. Forestry Sciences Lab.
For primary bibliographic entry see Field 2E.
W87-02929

FLUVIAL PROCESSES AND MORPHOLOGICAL THRESHOLDS IN INCISED CHANNEL RESTORATION,
Colorado State Univ., Fort Collins. Dept. of Earth Resources.
For primary bibliographic entry see Field 2J.
W87-02930

MORPHOLOGICAL FEATURES OF SMALL STREAMS: SIGNIFICANCE AND FUNCTION,
Oregon State Univ., Corvallis. Dept. of Forest Engineering.

R. L. Beschta, and W. S. Platts.
Water Resources Bulletin WARBAQ, Vol. 22, No. 3, p 369-380, June 1986. 10 fig, 51 ref.

Descriptors: *Channel morphology, *Channel erosion, *Small streams, *Aquatic habitats, Aquatic plants, Streams, Habitats, Pools, Riffles, Stream banks, Roughness coefficient, Fisheries, Bed-load discharge, Bank stabilization.

Land managers are becoming increasingly aware of the importance of small streams. Where channel morphology is modified or structural features are added, stream dynamics and energy dissipation need to be considered. Unit stream power, defined as the time-rate loss of potential energy per unit mass of water, can be reduced by adding stream obstructions, increasing channel sinousity, or increasing flow resistance with large roughness elements such as woody root systems, logs, boulders, or bedrock. Morphological features of small streams are pools, riffles, bed material, and channel banks. Pools, are important rearing habitats for fish. Riffles represent storage locations for bed material and are generally utilized for spawning. The particle sizes and distributions of bed material influence channel characteristics, bedload transport, food supplies for fish, spawning conditions, cover, and rearing habitat. Riparian vegetation helps stabilize channel banks and contributes in various ways to fish productivity. Understanding each stream feature individually and in relation to all others is essential for proper stream management. Channel morphology must ultimately be matched to the hydraulic, geologic, and vegetative constraints of a particular location. (Author's abstract)
W87-02931

STREAM IMPROVEMENTS AND FISH RESPONSE: A BIO-ENGINEERING ASSESSMENT,
Washington State Univ., Pullman. Dept. of Civil and Environmental Engineering.
J. F. Orsborn, and J. W. Anderson.
Water Resources Bulletin WARBAQ, Vol. 22, No. 3, p 381-388, June 1986. 3 fig, 1 tab, 23 ref.

Descriptors: *Stream improvements, *Interagency cooperation, *Bio-engineering, *Performance evaluation, *Fisheries, Habitats, Fish physiology.

The positive impacts of human modifications of natural streams are achieved through careful and timely planning, design, installation and monitoring of projects. Negative impacts are the results of rush jobs dictated by available money, a lack of consideration for limiting factors, untrained and inexperienced personnel, force-fitting structures instead of bending the flow, lack of a watershed plan, poor communication and cooperation among disciplines, not using the team approach, and single habitat solutions which neglect diversity and artificial constraints. These problems are discussed as an integrated, bio-engeneering approach threaded throughout the discussion of the problems and benefits associated with stream improvements and fish response. A general systems approach is presented which uses common language as a focal point for interdisciplinary communication, which is one of the major problems in resource management. Various conceptual models have been discussed to describe system complexities, and factors which constrain project evaluation in terms of biological, physical, economic and other components. Conclusions followed by recommendations for concerted and diversified efforts to improve our success in stream stewardship. (Author's abstract)
W87-02932

MANAGEMENT OF INSTREAM FLOWS THROUGH RUNOFF DETENTION AND RETENTION,
Bureau of Land Management, Lakewood, CO. Denver Service Center.
B. P. Van Haveren.
Water Resources Bulletin WARBAQ, Vol. 22, No. 3, p 399-404, June 1986. 2 fig, 31 ref.

Descriptors: *Instream flows, *Reservoirs, *Flood control, *Flow control, *Runoff control, *Runoff detention, *Retention, Flow, Hydrograph modification, Streamflow simulation, Feasibility studies.

The use of reservoirs and land treatments to manage streamflow for the maintenance or enchancement of instream flow values is a valid concept. Large reservoirs have been used for flood control and water-supply regulation while smaller structures have enjoyed widespread use for soil and water conservation in headwater areas. Where reservoir releases can be controlled, it is technically feasible to regulate flows for the enhancement of instream values. Retention and detention structures and land treatments, implemented for soil and water conservation purposes, have often had favorable effects on the streamflow hydrograph. Decreases in peak flows and increases in low flows have been documented. Design concepts for runoff-control structures are discussed in relation to instream flow management objectives. Hydrologic simulation is offered as a potential tool for project design and feasibility analysis. (Author's abstract)
W87-02934

TENMILE CREEK: A STUDY OF STREAM RELOCATION,
Colorado Div. of Wildlife, Fort Collins.
W. H. Babcock.
Water Resources Bulletin WARBAQ, Vol. 22, No. 3, p 405-415, June 1986. 3 fig, 3 tab, 7 ref. Colorado Div. of Wildlife Federal Aid Project F-54-R.

Descriptors: *Tenmile Creek, *Stream relocation, *Tenmile Canyon, *Fish habitats, *Stream improvements, Denver, Fish, Aquatic insects, Channeling, Channel morphology, Fish biomass, Population density, Construction.

To facilitate the construction of Interstate 70, which ran through Tenmile Canyon west of Denver, a three mile long creek was relocated. The project costing 0.5 million dollars was designed to provide fish habitats of equal value to these present before construction or, if possible, to improve the habitat. After two years of construction, a 4 percent chance flood occured at the project area which made almost 75 percent of the habitat stuctures ineffective. Pool-riffle ratios and quantity and quality of spawning areas remained essentially unchanged. Population estimates indicated an increase in the number of fish in the postconstruction period compared to preconstruction numbers. Fish biomass estimates for the project area were comparable for the two periods. Aquatic invertebrate populations had not anged as were indicated by comparison of three pre- and postconstruction indices. Rock deflectors and large habitat rocks were the only improvements likely to survive the flood and these structures had provided an improvement in fish habitat throughout the study period. The 4 percent chance flood contoured the stream components much like the original channel regardless of man's efforts. (Author's abstract)
W87-02935

POND MAINTENANCE,
H. J. Ritzer.
Grounds Maintenance, Vol. 21, No. 5, p 18+, May 1986.

Descriptors: *Ponds, *Aquatic weed control, Herbicides, Mechanical control, Mechanical equipment, Aerators, Shading.

There are many aquatic weed control methods, each having advantages and disadvantages. The relative benefits of aquatic herbicides, mechanical harvesting equipment, shading techniques and mechanical aerators for removal and control of aquatic weeds in ponds are discussed. (Michael-PTT)
W87-03018

4B. Groundwater Management

IXTAPA DRAFT AGREEMENT RELATING TO THE USE OF TRANSBOUNDARY GROUNDWATERS,
New Mexico Univ., Albuquerque. Natural Resources Center.
For primary bibliographic entry see Field 6E.
W87-02592

ALTERNATIVES TO THE USE OF AGRICULTURAL DRAINAGE WELLS,
Iowa State Univ., Ames. Dept. of Agricultural Economics.
R. S. Kanwar, J. L. Baker, and S. W. Melvin.
Water Resources Bulletin WARBAQ, Vol. 22, No. 4, p 573-579, August 1986. 2 fig, 4 tab, 20 ref.

Descriptors: *Drainage wells, *Water pollution sources, *Water pollution control, *Agricultural runoff, *Drainage effects, *Groundwater pollution, Iowa, Agricultural hydrology, Drainage practices, Drinking water, Economic evaluation, Economic impact, Economic prediction.

A large number of agricultural drainage wells (ADWs) that are located in north-central Iowa permit sediments, pesticides, nitrate and bacteria to enter regional aquifers used as drinking water sources. Some possible alternatives to control the entry of drainage waters into groundwater systems are reported and a methodology for comprehensive economic feasibility studies of alternative drainage outlets is described. The estimated cost of providing main subsurface drains range from $220 to $960 per hectare. If ADWs were eliminated without providing alternative drainage, the estimated average loss to area farmers would be at least $270 per hectare in reduced crop yields. Management practices to reduce pollutant load in ADW drainage water are also examined. (Author's abstract)
W87-02624

EFFICIENT RESPONSE MATRIX METHOD FOR COUPLING A GROUNDWATER SIMULATOR AND A REGIONAL AGRICULTURAL MANAGEMENT MODEL,
Safeway Stores, Inc., Oakland, CA.
P. H. Lemoine, E. G. Reichard, and I. Remson.
Water Resources Bulletin WARBAQ, Vol. 22, No. 3, p 417-424, June 1986. 1 fig, 2 tab, 16 ref.

Descriptors: *Groundwater levels, *Groundwater simulator, *Agricultural management models, *Salinas Valley, *Mathematical models, Aquifers, Groundwater models, Groundwater recharge, Coupled models, Pumping, Mathematical equations, Drawdown.

Consistent equations which relate the annual changes in groundwater depth in a given management subregion to the pumping and recharge stresses in all management subregions. An efficient response matrix method was developed by extending the concept of response matrix to consider 'active' and 'passive' effects. This method was developed for coupling a groundwater simulator and a regional agricultural management model, and aimed at eliminating the need to store all of the recovery information from preceding time periods. Active effects are those which occur during the actual application of a pumping or recharge stress while passive effects represent the recovery of water levels from an initial departure from steady-state conditions at the beginning of a time step. Derivation of the required matrices and a numerical example are presented for the Salinas Valley groundwater basin in California. (Author's abstract)
W87-02936

REGIME OF GROUND WATER OF SEMBERIAN AQUIFER,
Belgrade Univ. (Yugoslavia). Faculty of Agriculture.
For primary bibliographic entry see Field 2F.
W87-03043

RESULTS OF PUMPING TESTS IN THE DECCAN TRAP BASALTS OF CENTRAL INDIA,
Geraghty and Miller, Inc., Hackensack, NJ.

For primary bibliographic entry see Field 2F.
W87-03076

4C. Effects On Water Of Man's Non-Water Activities

TRANSPORT AND LOSS OF NITROUS OXIDE IN SOIL WATER AFTER FOREST CLEAR-CUTTING,
Yale Univ., New Haven, CT. School of Forestry and Environmental Studies.
For primary bibliographic entry see Field 5B.
W87-02912

TENMILE CREEK: A STUDY OF STREAM RELOCATION,
Colorado Div. of Wildlife, Fort Collins.
For primary bibliographic entry see Field 4A.
W87-02935

DISTRIBUTION OF BENTHIC MACROINVERTEBRATES IN A STREAM EXPOSED TO URBAN RUNOFF,
New Jersey Dept. of Environmental Protection, Trenton. Office of Science and Research.
For primary bibliographic entry see Field 5C.
W87-02939

POLLUTANTS ASSOCIATED WITH SAND AND SALT APPLIED TO ROADS IN MINNESOTA,
Metropolitan Council, St. Paul, MN.
For primary bibliographic entry see Field 5B.
W87-02943

MODELLING OF INDUSTRIAL ECOLOGICAL SYSTEMS FOR EVALUATION OF HEALTH SERVICES,
University of Occupational and Environmental Health, Kitakyushu (Japan). School of Medicine.
H. Ogawa, K. Sato, N. Jo, K. Noro, and K. Tsuchiya.
Ecological Modelling, ECMODT Vol. 31, No. 1-4, p 329-339, May 1986. 6 fig, 1 tab, 4 ref.

Descriptors: *Industry, *Health services, *Simulation models, *Ecological models, *Japan, Simulation, Agriculture, Manufacturing, Mathematical models, Scenario, History, Service sector, Death rates, Disease incidence, Human population, Prediction, Econometric models, Pollution, Carrying capacity.

A macroscopic industrial ecological model was developed to investigate the effects of changes in industrial structure on social well-being in general and health services in particular. The model is composed to various measures of industrial and employment structures, social and economic stocks, and environmental and pollution indicators as well as the health services sector. The simulation model was calibrated using available data for Japan over the last 60 yr and a simulation was conducted covering the period 1920-1980. The model results indicated a gradual shift in the industrial structure of Japan, from agriculture, light manufacture, and heavy industry in the past to more emphasis on commercial and service industries in recent and future years. This scenario would be associated with improvements in living standards, resulting in enhanced health service capability and lower death rate, but with increasing adult disease rates and decreasing environmental capacity to absorb pollution in the year 2000. (Rochester-PTT)
W87-02979

CHANGES IN CATCHMENT RUNOFF FOLLOWING DRAINAGE AND AFFORESTATION,
Institute of Hydrology, Wallingford (England).
M. Robinson.
Journal of Hydrology JHYDA7, Vol. 86, No. 1/2, p 71-84, September 1986. 5 fig, 3 tab, 30 ref. I. H. P. III Project 6.1.

Descriptors: *Catchment areas, *Runoff, *Drainage, *Reforestation, Forestry, Flow patterns, Rainfall-runoff relationships, Storm runoff, Surface flow, Soil water, Channel flow.

In many parts of N. Europe artificial drainage is necessary to establish plantation forestry. Data was collected from a small catchment to study the hydrological effects of a change in land use from rough moorland to plantation forestry. The forest is not yet mature, so the results to date mainly relate to the forestry drainage. The drainage resulted in a samll increase in the annual yields, largely through an increase in low flows. This increase was of a similar magnitude to that resulting from year to year weather variability. Drainage also altered the pattern of storm responses due to the reduced surface flow travel distances to a channel. The time to maximum flow was reduced by about one third. Peak flows were increased by the order of 20% and although this decreased with time, as the plantation forest grew and vegetation colonized the drains, 10 yrs after drainage peak flows were still 10% higher than before. Dip well data demonstrated the limited effect of the drains on soil moisture, with little increase in the soil water storage available to 'buffer' storm rainfall. (Author's abstract)
W87-03072

OVERCOMING NATURAL AND MAN-MADE OBSTACLES TO SOLVE URBAN FLOODING PROBLEMS,
Killam (Elston T.) Associates, Inc., Millburn, NJ.
N. M. DeNichilo.
Public Works PUWOAH, Vol. 117, No. 9, p 111-102, September 1986.

Descriptors: *Urban drainage, Pumping plants, Flooding, Detention reservoirs, Hydrology, Flood control, Newark, Design criteria, Flow characteristics.

Flooding in Newark, NJ had been a concern for a number of years. The flooding in many low-lying areas was due primarily to backwater and tidal effects from the main drainage channels that convey the flood water to Newark Bay. Flooding occurred even during relatively minor storms due to the small difference in elevation between the street level and the water level in Newark Bay and the Peripheral Ditch around Newark International Airport. The recently completed Newark Meadowlands Storm Water Pumping Station was designed to alleviate the flooding problem. The pump station was designed not merely to pump the ditch when storms occur, but to maintain a water elevation low enough prior to a storm to allow the ditch to provide storage and serve as a detention basin. Designed to pump at a maximum rate of 1,000 cfs (450,000 gpm), the pumping station is capable of preventing small storms from creating flooding. An extensive hydrologic study was conducted to determine the optimum operating levels and discharge rates associated with the station. Due to the complexity of the system, it was necessary to make several simplifying assumptions. For example, it was assumed that obstructions in the tributary drainage systems would first be removed to permit them to carry their full capacity. The study indicated that the existing drainage systems were capable of delivering a peak flow of approximately 1,800 cfs to the Peripheral Ditch system. This peak flow was estimated to be greater than the peak due to a one-year storm, but less than that of a five-year storm. Operation of the system during and after Hurricane Gloria (1985), special design features and conclusions were also discussed. (Alexander-PTT)
W87-03118

MECHANIZED TILLAGE SYSTEMS EFFECTS ON PROPERTIES OF A TROPICAL ALFISOL IN WATERSHEDS CROPPED TO MAIZE,
International Inst. of Tropical Agriculture, Ibadan (Nigeria).
For primary bibliographic entry see Field 2G.
W87-03162

EVAPORATION AND REDISTRIBUTION OF SALTS IN A SILT LOAM SOIL AS AFFECTED BY TILLAGE INDUCED SOIL MULCH,
Central Soil Salinity Research Inst., Karnal (India).
For primary bibliographic entry see Field 3F.
W87-03168

EFFECT OF SUBSOILING AND IRRIGATION ON POTATO PRODUCTION,
New Zealand Soil Bureau, Lower Hutt.
For primary bibliographic entry see Field 3F.
W87-03169

RUNOFF PROCESSES AND DISSOLVED SUBSTANCES DURING FLOOD EVENTS IN SMALL DIFFERENTLY USED DRAINAGE AREAS,
Wahnbachtalsperrenverband, Siegburg (Germany, F.R.).
For primary bibliographic entry see Field 2E.
W87-03283

COMPARISON OF WATER QUALITY IN DRAINAGE BASINS UNDER AGRICULTURAL AND FOREST LAND USE,
Giessen Univ. (Germany, F.R.). Inst. fuer Mikrobiologie und Landeskultur.
For primary bibliographic entry see Field 2E.
W87-03307

4D. Watershed Protection

IMPACTS OF WATER QUALITY IMPROVEMENT ON SITE VISITATION: A PROBABILISTIC MODELING APPROACH,
Economic Research Service, Washington, DC.
M. O. Ribaudo, C. E. Young, and J. S. Shortle.
Water Resources Bulletin WARBAQ, Vol. 22, No. 4, p 559-563, August 1986. 1 tab, 10 ref.

Descriptors: *Water quality, *Mathematical models, *Recreation demand, *Probabilistic process, Mathematical equations, Prediction, Bays, Vermont, Recreation facilities, Water demand.

A probabilistic choice model is used to determine whether a demand model for a recreation site should include non-users in the sample. The model is applied to the St. Albans Bay, Vermont recreational area. A hypothetical improvement in water quality was shown to greatly increase the probability of at least one visit to the bay, which implies that many people who do not presently use the bay might do so if water quality were improved. A demand model for predicting site visitation must include current non-users in the sample because failure to do so would be misleading in predictions of future demand. (Michael-PTT)
W87-02622

WATERSHED MODELING FOR FIRE MANAGEMENT PLANNING IN THE NORTHERN ROCKY MOUNTAINS,
Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.
D. F. Potts, D. L. Peterson, and H. R. Zuuring.
Research Paper PSW-177, October 1985. 4 fig, 4 tab, 19 ref.

Descriptors: *Model studies, *Watersheds, *Rocky Mountains, *Fire management, Watershed management, Simulation analysis, Water yield.

Two simulation models were adapted to estimate postfire changes in water yield and sediment production in northern Rocky Mountain watersheds. Data on topography, vegetation, and climate were used to simulate expected changes in resource production and value after wildfire. Management decisions were incorporated into the simulation approach. The results suggest that water yield increases were most affected by the amount of basal area killed by fire and removed by salvage logging, that estimated postfire due to increased water yield were substantial, and that losses due to increased sedimentation were negligible. This simulation approach can be useful to managers who need to

estimate long-term changes in water yield and value caused by wildfire. (Author's abstract)
W87-03323

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

TOXICITY TESTS OF AQUATIC POLLUTANTS BY USING COMMON DUCKWEED,
Illinois State Water Survey, Peoria. Water Quality Section.
W. Wang.
Environmental Pollution (Series B) EPSPDH, Vol. 11, No. 1, p 1-14, 1986. 6 fig, 4 tab, 20 ref.

Descriptors: *Duckweed, *Illinois, *Bioassay, *Water quality standards, Barium, Cadmium, Iron, Nickel, Selenium, Boron, Chromium, Copper, Lead, Phenols, Ecosystem.

A phytoassay procedure was developed for use with the common duckweed. The assay is simple, sensitive and economical. Those substances evaluated for relative toxicity by the phytoassay included most of the constituents listed in general standards for water quality from the state of Illinois. Based on duckweed assay, the maximum permissible concentrations of Ba, Cd, Fe, Ni and Se are lower than the water quality standards. Similar limits for B, Cr, Cu, F, Pb, Mn, SO4, and phenol are higher than those concentrations stipulated in the water quality standards. For Cl and Zn, the limits developed by the phytoassay are equal to the standards. The results suggest that duckweed, a floating, widespread, fast-growing plant, is a promising indicator of aquatic toxicity. The significance of a phytoassay is that plants are an essential part of an ecosystem, and as such, they should be protected in order to achieve a healthy environment. The strength of the duckweed assay is that it is simple, inexpensive, and sensitive. It requires no special skills and equipment. It can be used for screening or monitoring aquatic toxicity. Any indication of toxicity can then be followed up with a fish assay, if desired. Duckweed assay should be further explored so that its value can be evaluated when more data are available. (Peters-PTT)
W87-02582

CHIONE (AUSTROVENUS) STUTCHBURYI, A NEW ZEALAND COCKLE, AS A BIO-INDICATOR FOR LEAD POLLUTION,
Canterbury Univ., Christchurch (New Zealand). Dept. of Chemistry.
N. G. Purchase, and J. E. Fergusson.
Environmental Pollution (Series B) EPSPDH, Vol. 11, No. 1, p 137-151, 1986. 4 fig, 2 tab, 21 ref.

Descriptors: *Shellfish, *Bioindicators, *Lead, *Estuaries, Christchurch, New Zealand, Avon-Heathcote Estuary, Rainfall, Seasonal variation.

Both the soft tissue and the shell of the shellfish Chione (Austrovenus) stutchburyi were studied to investigate the factors that determine its suitability as a bio-indicator of lead pollution in an intertidal estuary fed by two small rivers. The shellfish were taken from the Avon-Heathcote Estuary, on the outskirts of Christchurch, New Zealand. The estuary, which covers an area of 6 sq km, is shallow and is separated from the ocean by a bar. Two small rivers, Avon and Heathcote, feed the estuary and drain approximately 200 sq km, of which about half is urbanized. Over four years, the mean lead level in the soft tissue was 1.16 microgram/g. The levels responded to significant rainfall events in the catchment area. Over the four years, a fall in lead levels corresponded to reduced lead inputs into a river feeding into the estuary. In addition to climatic and lead source changes, seasonal effects and shell size also need to be considered, as lead levels fall in the early summer and are elevated in small shellfish. The use of the shell as a bio-indicator for lead necessitates sectional and surface shell analysis rather than whole shell analysis. Both shell age and depth into the shell are variables that associate with lead. (Peters-PTT)
W87-02586

WATERBORNE VIRAL GASTROENTERITIS,
Health Effects Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5C.
W87-02612

GENERALIZATION AND APPLICATIONS OF TRACER DISPERSION DATA,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W87-02620

DETECTION OF ROTAVIRUS IN TREATED DRINKING WATER,
Texas Univ. Medical School at Houston.
For primary bibliographic entry see Field 5B.
W87-02643

GENOMIC ANALYSIS OF RNA VIRUSES ISOLATED FROM WATER,
Cape Town Univ. (South Africa). Dept. of Medical Microbiology.
M. T. Hodgkiss, and J. W. Moodie.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 15-21, October 1985. 5 fig, 11 ref.

Descriptors: *Viruses, *Genomic analysis, *Isolation, *Enteroviruses, *RNA, *Nucleic acids, *Pollutant identification, Electrophoresis, Water pollution, Wastewater, Genomes, Effluents.

Polyacrylamide gel electrophoresis (PAGE) was used to distinguish human from animal rotaviruses and type four reoviruses isolated from sewage effluent. A simple method of extracting the ds RNA was used without resorting to viral purification. The electrophoretic patterns were clearly discernible after silver nitrate staining. The human rotaviruses were of different strains and were clearly distinguishable from the simian agent. All four reoviruses were Type 3, but appeared to be of a different strain from the control type 3 with which they were compared. The feasibility of building a collection of various animal and human rotavirus and reovirus genomic profiles is discussed. (Author's abstract)
W87-02645

DETECTION OF HEPATITIS A VIRUS (HAV) IN DRINKING WATER,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
M. D. Sobsey, S. E. Oglesbee, D. A. Wait, and A. I. Cuenca.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 23-38, October 1985. 7 tab, 32 ref.

Descriptors: *Viruses, *Drinking water, *Human diseases, *Isolation, *Sample preparation, *Pollutant identification, Water quality management, Microbiological studies, Diseases.

Methods for concentrating enteric viruses from drinking water were evaluated for their ability to recover hepatitis A virus (HAV). HAV was efficiently adsorbed by both electronegative and electropositive filters at pH and ionic conditions previously used for other enteric viruses. Adsorbed HAV was efficiently eluted from these filters by beef extract eluents at pH 9.5. Eluted HAV was further concentrated by acid precipitation (organic flocculation). Using optimum adsorption conditions for each type of filter, HAV was concentrated > 100-fold from seeded tap water with about 50% recovery of the initial infectious virus. Electropositive filters were used to concentrate HAV from six samples of a fecally-contaminated groundwater supply implicated in an outbreak of hepatitis A in a rural community. HAV was detected and quantified in four of the six concentrate samples. The ability to recover and quantify HAV in contaminated drinking water with currently available methods should prove useful in further studies to determine the role of drinking water in HAV transmission. (Author's abstract)
W87-02646

DETECTION OF HEPATITIS A VIRUS IN DRINKING WATER BY ENZYME-IMMUNOASSAY USING ULTRACENTRIFUGATION FOR VIRUS CONCENTRATION,
Vienna Univ. (Austria). Hygiene Inst.
A. Schnattinger.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 39-41, October 1985. 5 ref.

Descriptors: *Viruses, *Sample preparation, *Drinking water, *Isolation, *Immunoassay, *Centrifugation, *Pollutant identification, Water analysis, Water quality management, Microbiological studies, Human diseases, Diseases, Assay.

Tap water seeded with a suspension of hepatitis A virus was treated with a two-stage technique for concentration of viruses from solutions with low virus titers. The first stage consists of aluminum hydroxide flocculation; the second stage consists of lysis of the aluminum hydroxide gel with citric acid/sodium citrate-buffer, separation of viruses from the lysate by ultracentrifugation, and suspension in phosphate buffer solution. Using commercial solid phase enzyme-linked immunosorbent assay (ELISA), HAV was detected in the 10,000:1 concentrates, but not in the original seeded samples; detection efficiency was about 50%, and the virus concentration was 5,000-fold. Although the percentage loss of HAV in comparison with the concentration by means of membrane filtration is similar, the ultracentrifugation method yields a larger sample/concentrate ratio, so that smaller amounts of HAV can be detected more efficiently because of the smaller end-volume. (Author's abstract)
W87-02647

CONCENTRATION OF SEEDED AND NATURALLY OCCURRING ENTEROVIRUSES FROM WATERS OF VARYING QUALITY BY HOLLOW FIBER ULTRAFILTRATION,
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Chemical and Environmental Engineering.
E. A. Bicknell, D. M. Dziewulski, L. S. Sturman, and G. Belfort.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 47-62, October 1985. 5 fig, 5 tab, 20 ref.

Descriptors: *Sample preparation, *Water analysis, *Enteroviruses, *Ultrafiltration, *Drinking water, *Wastewater, Identification of pollutants, Viruses, Filtration, Rivers, Isolation, Microbiological studies, Public health, Human diseases, Diseases, Water pollution.

A semi-automated hollow fiber ultrafiltration system was used to concentrate viruses from tap water, river water, and treated and untreated wastewater. Samples were dehydrated by filtration through an asymmetric polysulfone hollow fiber module with a molecular weight cut-off of 10,000 D. Retained solute was recovered from the filter by backwashing with water, buffer, and other solutions. One hundred liters of tap water seeded with poliovirus type 2 Sabin were processed in 161 minutes. Retained virus was recovered from the filter by backwashing with 150 ml of 0.05 M glycine, pH 10.0, which was further reduced to about 10 ml by organic flocculation. Average recovery of 60 plaque-forming units (PFU) of poliovirus from 100 liters of tap water was 148%. Hudson River water was processed in 218 minutes. Recovery of 114 PFU of poliovirus seeded into 99 liters of river water was 35%. No natural virus was recovered from unseeded river water. Naturally-occurring viruses, tentatively identified as echovirus type 14, coxsackie virus type A9, and coxsackie virus types B2-B5, were isolated from concentrates of treated and untreated wastewater. (Author's abstract)
W87-02648

RECOVERY OF VIRUSES FROM DRINKING-WATER BY MEANS OF AN IN-LINE ELECTROPOSITIVE CARTRIDGE FILTER,

National Inst. for Water Research, Pretoria (South Africa).
E. M. Nupen, and B. W. Bateman.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 63-69, October 1985. 1 fig, 6 tab, 10 ref.

Descriptors: *Pollutant identification, *Viruses, *Drinking water, *Filtration, *Sample preparation, *Isolation, Monitoring, Water quality management, Water pollution.

Tests were carried out to determine the efficiency of positively charged AMF-Cuno Virosorb cartridge filters in processing 100 l of tap water continuously seeded with varying dosages of different viruses. Viruses were desorbed by the cycling of a 3 g/l beef extract solution in 50 mM glycine-NaOH at pH 9.5 for five minutes, followed by immediate neutralization with 1 mol/l HCl. To avoid a second concentration step, the one-liter eluent was converted into growth medium by the addition of dehydrated Dulbecco's modified Eagle medium with decontamination by filtration through a 147 mm diameter 0.22 micron membrane. In 11 tests, virus recoveries were 75.9%. In subsequent tests, the virus seed was progressively reduced by one log at a time until the theoretical dosage was between one and ten 50% tissue culture infective dose (TCID50) virus per 100 liters of tap water. Virus could always be isolated from at least one to ten Nunc flasks which had been changed to the Virosorb eluent medium. Efficiency of the technique is compared for the recovery of poliovirus types 1 and 2, reovirus type 1, the SA 11 rotavirus, and coliphages. (Doria-PTT)
W87-02649

CONCENTRATION OF VIRUSES FROM WATER USING PIG ERYTHROCYTE GHOST CELLS,
Technion - Israel Inst. of Tech., Haifa. Dept. of Food Engineering and Biotectnology.
R. Armon, Y. Kott, and Y. Neeman.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 71-80, October 1985. 7 tab, 15 ref.

Descriptors: *Sample preparation, *Viruses, *Pollutant identification, *Culture media, *Water analysis, Bacteriophage, Flocculation, Monitoring, Isolation, Water pollution, Public health, Human Diseases, Diseases, Microbiological studies, Adsorption, Elution.

Ghost cells made from pig erythrocytes were used as a sorptive matrix to concentrate Poliovirus LSC-1 and bacteriophages phi x-174, MS-2, and f2 from small volumes of water. The adsorption-elution process was similar to the organic flocculation method with adsorption performed at pH 3.5, but erythrocyte membranes were used instead of beef extract floc. Adsorption ranged from 93% to 100% with various bacteriophages, and from 97% to 100% with Poliovirus LSC-1 strain. Elution ranged from 92% to 102% with bacteriophages, and from 84% to 347% with the Poliovirus. Comparing ghost cell results with 3% beef extract from different sources, the pig erythrocyte ghost cells were always found to be superior. (Author's abstract)
W87-02650

DETECTION OF ENTEROVIRUSES: AN ASSESSMENT OF TEN CELL LINES,
Severn-Trent Water Authority (England). Regional Lab.
R. Morris.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 81-88, October 1985. 1 fig, 6 tab, 20 ref.

Descriptors: *Pollutant identification, *Monitoring, *Isolation, *Enteroviruses, *Culture media, Water pollution, Water quality management, Public health, Viruses, Water analysis, Wastewater, Human diseases, Diseases, Microbiological studies.

The routine monitoring of waters and wastewaters using the BGM-suspended cell plaque assay system has resulted in high isolation rates for polio and coxsackie B viruses with echoviruses only rarely being detected. Ten cell lines were examined for their susceptibility to 26 enteroviruses and their ability to isolate naturally occurring enteroviruses in wastewater effluent. All the viruses produced cytopathic effect in the simian cell lines but only in the FL amnion line of human cells. The detection of naturally occurring enteroviruses was most efficient when BGM cells were used (82% of samples positive). RD cells gave 73% positive while chimpanzee liver gave 64%. However, BGM detected 50% of all plaques observed with RD and chimpanzee liver detecting 21% and 9%, respectively. The serotypes detected in this study were of the polio and coxsackie B groups, no echoviruses being identified. (Doria-PTT)
W87-02651

ANALYSIS OF TAP WATER FOR VIRUSES: RESULTS OF A SURVEY,
Hadassah Medical School, Jerusalem (Israel). Environmental Health Lab.
N. Guttman-Bass, and B. Fattal.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 89-96, October 1985. 2 fig, 4 tab, 7 ref. EPA Grant CR 806416.

Descriptors: *Pollutant identification, *Water analysis, *Viruses, *Drinking water, *Isolation, *Surveys, Israel, Water quality, Public health.

A preliminary report is presented on the results of a survey which assayed drinking water for viruses on 30 rural settlements in Israel. Over a period of a year and a half, 111 samples were tested, of which three were positive for viruses. The positive samples were from closely situated settlements, and were of relatively good bacteriological quality. The isolates were found in 300-liter samples which were concentrated on-site rather than in the laboratory (100-liter samples) and by plaque assay rather than cytopathic effect. Out of a total of 20,000 liters of water processed, five plaques were isolated. (Author's abstract)
W87-02652

DETECTION AND HEALTH RISK ASSOCIATED WITH LOW VIRUS CONCENTRATION IN DRINKING WATER,
Institut Armand-Frappier, Laval (Quebec). Centre de Recherche en Virologie.
P. Payment, and M. Trudel.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 97-103, October 1985. 2 fig, 14 ref.

Descriptors: *Pollutant identification, *Water pollution effects, *Risks, *Viruses, *Drinking water, *Public health, Water quality management, Water quality standards, Probabilistic process, Water treatment, Enteroviruses, Human diseases, Diseases, Microbiological studies, Isolation.

The isolation of viruses in treated drinking water has been reported more frequently than ever during the last decade as a result of the amelioration of detection methods and the increasing number of studies on the subject. These reports have in common the very low number of viruses isolated, and the fact that these viruses are usually found only after concentration procedures involving several hundred liters of water. The authors' studies show that 99.998% of the indigenous viruses are removed during the conventional treatment of drinking water. The residual viral fraction does not exceed 10 viruses per 1,000 liters of water. Using a probabilistic approach, this viral concentration in drinking water is well below any dangerous level of enteric viruses in water, and the presence of these viruses should not be considered as a health problem, but more as the limit of the water treatment methodology. (Author's abstract)
W87-02653

FAILURE TO DETECT CYTOPATHIC ENTEROVIRUSES IN DRINKING WATER,
Severn-Trent Water Authority (England). Regional Lab.
R. Morris, and D. N. Sharp.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 105-109, October 1985. 1 tab, 20 ref.

Descriptors: *Enteroviruses, *Drinking water, *Pollutant identification, *Public health, *Water pollution, Surveys, Monitoring, Water treatment.

No cytopathic enteroviruses were detected in 284 samples of drinking water. A total volume of 135,000 liters from 265 locations was examined. Elution of adsorbed viruses was accomplished using beef extract, followed by organic flocculation. While these findings confirm that no gross contamination of water supplies is occurring, it does not preclude the possibility of occasional low-level contamination. (Doria-PTT)
W87-02654

VIRUSES AND BACTERIA IN A CHALK WELL,
Thames Water Authority, London (England).
For primary bibliographic entry see Field 5B.
W87-02655

SOME EXPERIMENTAL DISCUSSION OF ACCURACIES IN QUANTITATIVE VIRUS ASSESSMENT FOR WATER SUPPLY,
Kyoto Univ. (Japan).
H. Sumitomo.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 127-138, October 1985. 18 fig, 4 tab, 6 ref.

Descriptors: *Viruses, *Water analysis, *Pollutant identification, *Statistical analysis, *Water quality management, Chlorination, Statistical methods, Mathematical studies, Water treatment, Public health.

A quantitative assessment of chlorination is presented, balancing the effects on human health of both viruses and trihalomethanes (THM) formed during the chlorination process. The study uses Lake Biwa as a representative sample of a water resource in Japan. Statistical handling of data was revealed to be important because of the statistical nature of the data: since both concentrations are very low in tap water, it was necessary to quantify both the effects and concentrations with probabilities. The first part of the paper shows a statistical procedure and numerical results of the assessment of virus and THM risks. The second part discusses some results of accuracies in virus experiments. These experiments concerning statistical problems are particularly important for more precise assessment of the public risk of viruses in tap water. (Doria-PTT)
W87-02656

INTERACTIONS BETWEEN BIOTIC AND ABIOTIC FACTORS AND VIRUSES IN A WATER SYSTEM,
Medizinische Akademie 'Carl Gustav Carus' Dresden (German D.R.). Inst. fuer Allgemeine und Kommunale Hygiene.
For primary bibliographic entry see Field 5B.
W87-02657

DETECTION OF INDIGENOUS ENTERIC VIRUSES IN RAW SEWAGE EFFLUENTS OF THE CITY OF ATHENS, GREECE, DURING A TWO YEAR SURVEY,
Institut Pasteur Hellenique, Athens (Greece). Dept. of Virology.
For primary bibliographic entry see Field 5B.
W87-02659

BACTERIA AND VIRUSES IN AEROBICALLY DIGESTED SLUDGE: INFLUENCE OF PHYSICAL AND CHEMICAL TREATMENTS ON SURVIVAL AND ASSOCIATION WITH FLOCS UNDER LABORATORY CONDITIONS,
Florida Univ., Gainesville. Dept. of Microbiology and Cell Science.
For primary bibliographic entry see Field 5D.
W87-02660

DETECTION AND STABILITY OF ENTERIC VIRUSES IN SLUDGE, SOIL AND GROUND WATER,
Kongelige Veterinaer- og Landbohoejskole, Copenhagen (Denmark). Dept. of Veterinary Virology and Immunology.
For primary bibliographic entry see Field 5B.
W87-02662

MICROBIAL POLYMERS IN THE AQUATIC ENVIRONMENT-III: ISOLATION FROM RIVER, POTABLE AND UNDERGROUND WATER AND ANALYSIS,
Guelph Univ. (Ontario). Dept. of Zoology.
For primary bibliographic entry see Field 5B.
W87-02696

SEASONAL, BEHAVIORAL AND GROWTH CHANGES OF JUVENILE CORBICULA FLUMINEA EXPOSED TO CHRYSOTILE ASBESTOS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5C.
W87-02699

ANOMALOUS BINDING OF ORGANIC CONTAMINANTS MAY BE ARTIFACTUAL DUE TO RADIOCHEMICAL IMPURITIES,
Hydrological Research Inst., Pretoria (South Africa).
J. F. McCarthy, B. D. Jimenez, G. R. Southworth, D. M. DiToro, and M. C. Black.
Water Research WATRAG, Vol. 20, No. 10, p1251-1254, October 1986. 2 fig, 14 ref. DOE Contract DE-AC05-840R21400.

Descriptors: *Radiochemical analysis, *Binding, *Pollutants, *Sediments, Humic substances, Partition coefficients, Adsorption, Desorption, Hysteresis, Fate of pollutants, Errors, Chemical analysis, Sorbents.

A potential artifact (caused by relatively small amounts of radiochemical impurities in solutions of radiolabeled sorbates) is described that could lead to erroneous estimates of the partition coefficients for binding of contaminants to sorbents such as soil, sediment, or dissolved humic material. The following types of errors could result from data affected by this artifact: partition coefficients for sorption could be underestimated; systems in which binding was fully reversible could appear to be at least partially nonreversible and partition coefficients could appear to decrease as the sorbent concentration increased. Several criteria such as reagent quality checks, purification of reagents, experiment verification and data interpretation are suggested to assure that experimental results are not affected by this artifact. (Author's abstract)
W87-02700

MEMBRANE FILTRATION ENUMERATION OF FAECAL CLOSTRIDIA AND CLOSTRIDIUM PERFRINGENS IN WATER,
Hydrological Research Inst., Pretoria (South Africa).
D. P. Sartory.
Water Research WATRAG, Vol. 20, No. 10, p 1255-1260, October 1986. 2 tab, 28 ref.

Descriptors: *Membrane filtration, *Water analysis, *Domestic wastes, *Culture media, *Clostridium, *Effluents, Surface water, Motility, Nitrate reduction, Pathogenic bacteria, Bioindicators, Sewage bacteria, Wastewater analysis, Enumeration, Microbiology, Feces.

The use of egg yolk-free tryptose-sulphite-cycloserine (TSC) agar for the membrane filtration enumeration of Clostridium perfringens was evaluated using domestic sewage effluents and polluted surface waters. A medium containing polymixin (mCP) is a highly selective for C. perfringens. Although not as selective as mCP, egg yolk-free TSC agar is a cheaper and suitable alternative which allows greater recoveries of C. perfringens. Egg yolk-free TSC agar incubated at 45 C appears to be selective for sulfite reducing clostridia of fecal origin. The two tube/four test (MNLG) procedure for motility, nitrate reduction, lactose fermentation and gelatin liquefaction is an easy reliable method for the confirmation of C. perfringens from egg yolk-free TSC agar. Based upon enumeration on egg yolk-free TSC agar, analysis for fecal clostridia and C. perfringens offers a potentially valuable test for microbiological water quality assessment. (Alexander-PTT)
W87-02701

IMPROVED METHOD FOR RECOVERY OF ENTERIC VIRUSES FROM WASTEWATER SLUDGES,
Health Effects Research Lab., Cincinnati, OH.
C. J. Hurst, and T. Goyke.
Water Research WATRAG, Vol. 20, No. 10, p 1321-1324, October 1986. 1 fig, 3 tab, 11 ref.

Descriptors: *Enteroviruses, *Elution, *Sludge disposal, *Wastewater treatment, *Flocculation, *Effluents, Adsorption, Health hazards, Industrial wastewater, Sludge solids, Hydrogen ion concentration, Activated sludge, Filters, Linear regression, Reciprocal correlation.

Various parameters involved in recovering indigenous enteric viruses from wastewater sludges aided by buffered beef extract elution and subsequent flocculation concentration were examined. A statistically significant ($P = 0.03$) reciprocal correlation was found to exist between the ratio of eluant to sludge solids content used during the elution step, and the efficiency of subsequently concentrating viruses from the produced sludge eluates by means of organic flocculation. A hypothesis is proposed by which to explain the concentration of viruses during beef extract-induced organic flocculation. Making two improvements in the ASTM method for recovering indiginous viruses will improve its consistentcy for use in environmental studies. These modifications are: adjustment of pH prior to AlCl3 addition during the adsorption step, and using a constant ratio of 5 volumes of eluant per volume of sludge solids during the elution step. (Alexander-PTT)
W87-02710

CONCENTRATIONS OF 20 VOLATILE ORGANIC COMPOUNDS IN THE AIR AND DRINKING WATER OF 350 RESIDENTS OF NEW JERSEY COMPARED WITH CONCENTRATIONS IN THEIR EXHALED BREATH,
Environmental Protection Agency, Washington, DC.
For primary bibliographic entry see Field 5B.
W87-02774

GROWTH OF SALMONELLAS IN DIFFERENT ENRICHMENT MEDIA,
National Environmental Engineering Research Inst., Nagpur (India).
M. D. Patil, and N. M. Parhad.
Journal of Applied Bacteriology JABAA4, Vol. 61, No. 1, p 19-24, July 1986. 1 fig, 4 tab, 15 ref.

Descriptors: *Growth, *Salmonella, *Culture media, *Microbiological studies, *Bacterial analysis, Culturing techniques, Water analysis, Bacteria, Pseudomonas, Citrobacter, Proteus, Escherichia coli, Enterobacters, Enteric bacteria, Isolation.

The usefulness of selenite-F (S-F), tetrathionate (MKT), and Rappaport-10 (R-10) broths as enrichment media to support growth of salmonellas either alone or in the presence of other competing organisms was studied. The ability of these media to support the growth of stressed salmonellas from water was also investigated. R-10 was found to be more inhibitory to competing organisms than were MKT and S-F. R-10 strongly inhibited the growth of Pseudomonas aeruginosa, Citrobacter freundii, and Proteus vulgaris, but not that of Escherichia coli and Enterobacter aerogenes. However, it was more toxic to small numbers of salmonellas than were MKT and S-F. Tetrathionate was strongly inhibitory to E. coli and Ent. aerogenes but much less so to Proteus and Pseudomonas species. Selenite-F was much less inhibitory than MKT to Ps. aeruginosa and did not inhibit growth of E. coli and Ent. aerogenes as much as did MKT. Salmonellas were inhibited by all three enrichment media, and none of them is ideally suited for direct use. Of the three media, R-10 was much more inhibitory to stressed organisms than S-F or MKT. (Author's abstract)
W87-02786

CONTAMINATING PEPTIDES WIDELY PRESENT IN ION-EXCHANGED WATER, REAGENTS, EXPERIMENTAL IMPLEMENTS AND NATURAL SAMPLE,
Azabu Univ., Sagamihara (Japan). Faculty of General Education.
For primary bibliographic entry see Field 5B.
W87-02787

R-PLASMID TRANSFER IN SOIL AND WATER,
Guelph Univ. (Ontario). Dept. of Environmental Biology.
For primary bibliographic entry see Field 5C.
W87-02792

AUTOMATED PREVALVE DILUTION IN FLOW-INJECTION ANALYSIS: THE AUTOMATED DETERMINATION OF CHLORIDE IN SURFACE, GROUND AND DOMESTIC WATER,
Pretoria Univ. (South Africa). Dept. of Chemistry.
J. F. van Staden.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 322, No. 1, p 36-41, September 1985. 4 fig, 2 tab, 20 ref.

Descriptors: *Chemical analysis, *Automation, *Sample preparation, *Pollutant identification, *Chlorides, *Flow-injection analysis, *Water analysis, Groundwater, Domestic water, Surface water.

An automated method for the determination of chloride in surface, ground, and domestic water is described, based on the concept of flow-injection analysis. Samples of widely varying chloride content up to 800 mg/l are analyzed by an automated prevalve dilution technique with a sampling rate of 92 samples per hour. The measurement is based on the red-colored iron thiocyanate complex. The method is suitable for the analysis of chloride with a coefficient of variation of better than 1.2%. Results demonstrate that it is possible to use automated prevalve dilution to extend the linearity of calibration curves. The flow-injection procedure is suitable for carrying out chloride analysis in the range of 0-120 mg/l at a rate of 150 samples/hr as well as above this range at a sampling rate of 92 samples/hr by using the same manifold, the latter made possible by a simple change to automated prevalve dilution. (Doria-PTT)
W87-02793

POSSIBILITIES OF IMPROVING THE DETERMINATION OF EXTREMELY LOW LEAD CONCENTRATIONS IN MARINE FISH BY GRAPHITE FURNACE ATOMIC ABSORPTION SPECTROMETRY,
Bundesforschungsanstalt fuer Fischerei, Hamburg (Germany, F.R.).
U. Harms.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 322, No. 1, p 53-56, September 1985. 1 fig, 1 tab, 22 ref.

Descriptors: *Chemical analysis, *Pollutant identification, *Lead, *Fish, *Heavy metals, *Marine animals, *Atomic absorption spectroscopy, *Trace levels, Separation techniques, Sample preparation, Detection limits, Spectroscopy, Cod, Plaice.

A multi-stage analytical procedure was developed to produce reliable data on lead levels in marine fish. The method combines graphite furnace atomic absorption spectrometry with pre-instrumental chemical sample treatment. The latter consists of decomposition with nitric acid followed by separation and enrichment of lead traces by solvent extraction. The detection limits of the method

were demonstrated in a study of cod and plaice from the North Sea. Results from muscle tissue ranged from 0.5 to 4.1 ng/g (2.4-20 nmol/kg wet weight), considerably below most data in the literature. (Doria-PTT)
W87-02794

DETERMINATION OF LEAD, CADMIUM AND THALLIUM IN WATER SAMPLES AT PPB AND PPT LEVELS BY ISOTOPE DILUTION MASS SPECTROMETRY, (BESTIMMUNG VON BLEI, CADMIUM UND THALLIUM IN WASSERPROBEN IM PPB- UND PPT-BEREICH DURCH MASSENSPEKTROMETRISCHE ISOTOPENVERDUNNUNGSANALYSE),
Regensburg Univ. (Germany, F.R.). Inst. fuer Anorganische Chemie.
J. Trettenbach, and K. G. Heumann.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 322, No. 3, p 306-310, October 1985. 4 tab, 14 ref.

Descriptors: *Lead, *Cadmium, *Isotope dilution, *Heavy metals, *Thallium, *Chemical analysis, *Water analysis, *Isotope studies, *Mass spectrometry, *Trace levels, Pollutant identification, Radioisotopes, Drinking water, Spring water, Indicators, Detection limits.

An analytical procedure that uses isotope dilution mass spectrometry for the simultaneous determination of lead, cadmium, and thallium traces in water down to the ppt-level is described. This analysis is especially useful for calibrating other analytical methods. Cathodic electrodeposition is used to separate the metals. A spike solution containing Pb, Cd, and Tl is applied for the isotope dilution technique. Positive thermal ions of the elements are successively measured by increasing the temperature of the filament in a single-filament ion source. The blank contribution of chemicals of different degrees of purity for the analytical procedure was investigated, and different spring water samples dependent on the type of soil were analyzed. Drinking water samples showed a significant difference in the heavy metal concentration depending on the frequency with which the waterpipe was used; thallium was found to be an especially sensitive indicator. In contrast to thallium, a high portion of lead and cadmium is fixed at small particles which can be included in the drinking water or is adsorbed at the surface of a quartz vessel. (Author's abstract)
W87-02795

DETERMINATION OF TRACES OF TIN IN AQUEOUS MATRICES BY VOLTAMMETRY AND ATOMIC ABSORPTION SPECTROMETRY, (BESTIMMUNG VON ZINNSPUREN IN WASSRIGEN MATRICES MIT VOLTAMMETRIE UND ATOMABSORPTIONSSPEKTROMETRIE),
Institut fuer Spektrochemie und Angewandte Spektroskopie, Dortmund (Germany, F.R.).
G. Weber.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 322, No. 3, p 311-314, October 1985. 1 fig, 3 tab, 9 ref.

Descriptors: *Chemical analysis, *Water analysis, *Trace levels, *Tin, *Voltammetry, *Atomic absorption spectroscopy, Pollutant identification, Urine, Foods, Trace metals, Ion exchange, Sample preparation, Chemical reactions.

Low concentrations of tin were detected in water, urine, and some foods (total content 0.5 nanogram(ng)/ml to 6 microgram/ml). Enrichment techniques like ion-exchange and extraction with tropolone/toluene were used for the determination of low concentrations. The final measurements by AAS and anodic stripping voltammetry give consistent results. The combination of different sample pretreatment steps with the determination provided additional information about chemical forms and mobility of tin in water and foods. The mobilization of tin by acid, base, and complexing agents differs very much depending on the food matrix. (Author's abstract)
W87-02796

TRACE DETERMINATION OF CHROMIUM IN VARIOUS WATER TYPES BY ADSORPTION DIFFERENTIAL PULSE VOLTAMMETRY,
Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Angewandte Physikalische Chemie.
J. Golimowski, P. Valenta, and H. W. Nurnberg.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 322, No. 3, p 315-322, October 1985. 11 fig, 1 tab, 27 ref.

Descriptors: *Trace levels, *Chromium, *Chemical analysis, *Water analysis, *Voltammetry, Sample preparation, Catalysts, Adsorption, Nitrates, Bromates, Optimization, Lakes, Rivers, Rainwater, Seawater.

A new sensitive voltammetric method for the determination of trace amounts of total chromium (trivalent and hexavalent) in natural waters is presented. The method is based on the preconcentration of the Cr(III)-diethylenetriaminepeutacetic acid (DTPA) complex by adsorption, followed by reduction, producing a response with a peak potential of -1.22 V. The peak height of the Cr(III) reduction is measured. The catalytic action of nitrate and bromate ions on the Cr(III)-DTPA reduction was elucidated using cyclic voltammetry. The adsorption of chromium complexes at the hanging mercury drop electrode (HMDE) was investigated using out-of-phase a.c. voltammetry, and the potential range of adsorption was determined. Optimal conditions for the determination of the total chromium concentration in the range 20-2,000 ng/l were established based on the results. The determination limit is 20 ng/l, and the RSD is 5% for chromium concentrations greater than or equal to 200 ng/l. The usefulness and wide scope of this new method down to ultra-trace levels was demonstrated by determinations of the total dissolved chromium content in river, lake, sea, and rain water. (Author's abstract)
W87-02797

FLOW INJECTION ANALYSIS OF CHLORIDE IN TAP AND SEWAGE WATER USING ION-SELECTIVE ELECTRODE DETECTION,
Ulm Univ. (Germany, F.R.). Abt. Analytische Chemie.
L. Ilcheva, and K. Cammann.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 322, No. 3, p 323-326, October 1985. 8 fig, 11 ref.

Descriptors: *Chemical analysis, *Drinking water, *Chlorides, *Ion-selective electrode detection, *Water analysis, *Wastewater analysis, Iodides, Wastewater, Bromides.

The application of a chloride-selective electrode to flow injection analysis of chloride in tap and sewage water samples is described. From 60 to 120 samples per hour can be analyzed with an extremely simple experimental set-up. The standard deviation is 5% when the chloride content is above 100 ppm, and 10% at 10 ppm chloride. Using an AgCl single crystal ion-selective electrode and high carrier solution flow rates, interfering anions such as iodide and bromide are kinetically discriminated against and interfere only at orders of magnitude less than usual. (Author's abstract)
W87-02798

MULTIELEMENT TRACE PRECONCENTRATION FROM WATER ON ACTIVATED CARBON FOR THE SAMPLE PRETREATMENT FOR ATOMIC SPECTROSCOPY (FLAME-AAS, ICP/OES), (MULTIELEMENT-SPURENANREICHERUNG AUS WASSERN AN AKTIVKOHLE ZUR PROBENVORBEREITUNG FUR DIE ATOMSPEKTROSKOPIE (FLAMMEN-AAS, ICP/OES)),
Institut fuer Spektrochemie und Angewandte Spektroskopie, Dortmund (Germany, F.R.).
H. Berndt, U. Harms, and M. Sonneborn.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 322, No. 3, p 329-333, October 1985. 5 tab, 8 ref.

Descriptors: *Sample preparation, *Water analysis, *Activated carbon, *Atomic absorption spectroscopy, *Heavy metals, *Trace elements, *Chemical analysis, Carbon, Metals, Pollutant identification, Bismuth, Cadmium, Copper, Cobalt, Nickel, Lead, Zinc, Seawater, Filtration, Separation techniques, Detection limits.

Trace levels of Bi, Cd, Cu, Co, In, Ni, Pb, Tl, and Zn can be separated from 10-100 ml water samples (sea, mineral, and drinking water) using the complexing agent APDTC and a simple filtration step with an activated carbon-lined filter. Detection limits of < 1 microgram per liter can be obtained applying flame-atomic absorption spectrometry or ICP/OES techniques to the preconcentrated sample. Relative standard deviations are generally 4% for the entire analysis for both detection methods for trace concentrations in the microgram per liter range. (Doria-PTT)
W87-02799

STUDIES ON SEDIMENTS OF THE RIVER LAHN: 1. ANALYTICAL RESULTS, (UNTERSUCHUNGEN AN LAHNSEDIMENTEN: 1. ANALYTISCHE ERGEBNISSE),
Marburg Univ. (Germany, F.R.). Fachbereich Chemie.
For primary bibliographic entry see Field 5B.
W87-02800

STUDIES ON SEDIMENTS OF THE RIVER LAHN: 2. CHEMOMETRIC EVALUATION, (UNTERSUCHUNGEN AN LAHNSEDIMENTEN: 2. CHEMOMETRISCHE AUSWERTUNG),
Marburg Univ. (Germany, F.R.). Fachbereich Chemie.
For primary bibliographic entry see Field 5B.
W87-02801

SELECTIVE PRECONCENTRATION OF COPPER FROM AQUEOUS SOLUTION BY USING KERATEINE GEL,
Fukui Univ. (Japan). Faculty of Engineering.
J. Miura, M. Yamada, and Y. Nakamura.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 321, No. 6, p 575-577, July 1985. 3 fig, 3 tab, 9 ref.

Descriptors: *Karateine gel, *Heavy metals, *Copper, *Chemical analysis, *Sample preparation, *Water analysis, Oxidation, Atomic absorption spectroscopy, Pollutant identification, Thiols.

A selective preconcentration technique for copper is described using keratein gel. The gel is prepared by partial oxidation of karateine, which is obtained by reducing the disulfide bonds of wool fiber. Copper is selectively adsorbed on the gel at pH 3.5, eluted with 3 M hydrochloric acid, and determined by atomic absorption spectrometry. This method has been applied to the determination of copper in river water. The effects of free thiol content, pH, shaking time, and sample volume are discussed. Better than 98-102% recovery was obtained with satisfactory precision. (Author's abstract)
W87-02802

INVESTIGATIONS ON THE APPLICATION OF THE ION-EXCHANGER SRAFION NMRR FOR THE ENRICHMENT AND SEPARATION OF URANIUM AND OTHER TRACE ELEMENTS FROM SEA WATER, (UNTERSUCHUNGEN UBER DIE VERWENDBARKEIT DES IONENAUSTAUSCHERS SRAFION NMRR ZUR ANREICHERUNG UND ABTRENNUNG VON URAN UND ANDEREN SPURENELEMENTEN AUS DEM MEERWASSER),
Athens Univ. (Greece). Inst. of Inorganic and Analytical Chemistry.
M. Ochsenkuhn-Petropulu, and G. Parissakis.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 321, No. 6, p 581-586, July 1985. 5 fig, 6 tab, 24 ref.

Descriptors: *Ion exchange, *Separation, *Sample preparation, *Sampling, *Uranium, *Trace elements, *Chemical analysis, *Water sampling, *Sea water, *Water analysis, Trace metals, Metals,

Heavy metals, Molybdenum, Silver, Chromium, Copper, Iron, Manganese, Nickel, Lead, Zinc, Vanadium, Reagents, Atomic absorption spectroscopy.

Batch and continuous flow experiments have demonstrated the usefulness of the ion exchanger SRAFION NMRR for the preconcentration and separation of uranium and other trace elements (e.g., Mo, V, Ag, Cr, Cu, Fe, Mn, Ni, Pb, and Zn) from sea water. The eluant selected was 0.5N HNO3. Uranium was extracted from the eluate with 0.1M tri-normal-octylphosphine oxide (TOPO)/cyclohexane and analyzed in the organic extract by differential-pulse polarography, while the other elements were determined directly in the eluate by atomic absorption spectrometry. This method enabled the determination of the above-mentioned trace elements in sea water of the Isthmus of Corinth area, Greece. (Doria-PTT)
W87-02803

PRESERVATION OF TRACES OF CHROMIUM(VI) IN WATER AND WASTE WATER SAMPLES,
CIBA-GEIGY A.G., Basel (Switzerland). Central Analytical Dept.
J. Pavel, J. Kliment, S. Stoerk, and O. Suter.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 321, No. 6, p 587-591, July 1985. 6 fig, 2 tab, 15 ref.

Descriptors: *Wastewater analysis, *Water sampling, *Sample preservation, *Chemical analysis, *Trace levels, *Chromium, *Water analysis, Wastewater, Trace metals, Trace elements, Heavy metals, Acidity, Temperature, Chemical properties, Reagents.

The lifetime of hexavalent chromium was studied as a function of pH, container material, initial concentration, and temperature in pure water solutions. It was found that long-term stability was best at pH 9, and that Cr(VI) in polyethylene containers deteriorates more rapidly than in glass, while cooling does not prolong its lifetime. If present, trivalent chromium must be chelated to prevent its oxidation. Procedures for preservation of samples for determination of Cr(VI) in water and wastewater are made based on these results. Losses of Cr(VI) over seven days can be reduced from 60-80% to less than 20% by using a preservation solution containing carbonate buffer (pH 9) and EDTA. (Author's abstract)
W87-02804

$5.00, 1-MINUTE EFFLUENT QUALITY TESTER,
Salina Area Vocational-Technical School, KS.
For primary bibliographic entry see Field 7B.
W87-02814

SALMONELLAE AND POLLUTION INDICATOR BACTERIA IN MUNICIPAL AND FOOD PROCESSING EFFLUENTS AND THE CORNWALLIS RIVER,
Environmental Protection Service, Dartmouth (Nova Scotia).
For primary bibliographic entry see Field 5D.
W87-02815

DETERMINATION OF ACRYLIC ACID IN AQUEOUS SAMPLES BY ELECTRON CAPTURE GAS CHROMATOGRAPHY AFTER EXTRACTION WITH TRI-N-OCTYLPHOSPHINE OXIDE AND DERIVATIZATION WITH PENTAFLUOROBENZYL BROMIDE,
Florida Inst. of Tech., Melbourne. Dept. of Oceanography and Ocean Engineering.
A. Vairavamurthy, M. O. Andreae, and J. M. Brooks.
Analytical Chemistry ANCHAM, Vol. 58, No. 13, p 2684-2687, November 1986. 3 fig, 2 tab, 32 ref. NSF Grant OCE-8315733 and OCE-8301538.

Descriptors: *Pollutant identification, *Water analysis, *Sample preparation, *Performance evaluation, *Gas chromatography, *Acrylic acid, Tri-n-octylphosphine oxide, Pentafluorobenzyl bromide, Detection limits, Extraction.

A method is described for the determination of acrylic acid at nanomolar concentrations in complex aqueous samples. The method involves extraction and preconcentration from the acidified sample using tri-n-octylphosphine oxide dissolved in methyl tert-butyl ether and subsequent derivatization with pentafluorobenzyl bromide using 18-crown-6 as catalyst. The pentafluorobenzyl ester of acrylic acid is then quantified by capillary gas chromatography with electron capture detection. The limit of detection is about 6 femtomole, corresponding to a concentration of 3 nmol/l of the acid in a 100-ml sample. Acrylic acid has been measured in aqueous samples, including natural waters, to illustrate the performance of this procedure. (Author's abstract)
W87-02818

CONTINUOUS MONITORING OF 222RN CONCENTRATION IN UNCONFINED GROUNDWATER,
Kyoto Univ., Osaka (Japan). Research Reactor Inst.
M. Fukui.
Journal of Hydrology JHYDA7, Vol. 82, No. 3/4, p 371-380, December 30, 1985. 8 fig, 4 ref.

Descriptors: *Monitoring, *Radonisotopes, *Groundwater pollution, *Radioisotopes, *Pollutant identification, *Fate of pollutants, Aeration zone, Radioactive waste disposal, Waste disposal, Tracers, Observation wells, Wells, Precipitation, Infiltration.

A continuous monitoring method for 222Rn concentration in unconfined groundwater was investigated to obtain information as to the lower boundary concentration of radon in the aerated zone. Prior to monitoring, a tracer test using bromide ion was performed to investigate the groundwater exchange in observation wells. The monitoring system was able to follow closely the radon concentration in unconfined groundwater. In this system, part of the pumped groundwater was circulated and sprayed from a nozzle in the same casing, and exhaled radon was measured; the remaining water was reinjected into another casing. The main effects observed in change of radon concentration were the dilution effect of infiltrating water following precipitation and the rate of recovery of equilibrium between 222Rn and 226Rn. The monitoring method may serve for the detection of 226Ra migrating from a nuclear wastes repository, and generally for understanding of radon dynamics in unconfined groundwater close to ground surface. (Author's abstract)
W87-02847

PRACTICAL DIRECT PLAQUE ASSAY FOR COLIPHAGES IN 100-ML SAMPLES OF DRINKING WATER,
National Inst. for Water Research, Pretoria (South Africa).
W. O. K. Grabow, and P. Coubrough.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 3, p 430-433, September 1986. 7 tab, 25 ref.

Descriptors: *Double-agar-layer method, *Coliphages, *Enteroviruses, *Single-agar-layer method, *Bioindicators, *Water treatment process, *Drinking water, Water quality standards, Disinfection, Wastewater, Incubation, Growth media, Seawater, Plaque assay.

A new single-agar-layer assay (NS) proved superior to other methods for the detection of coliphages in 100-ml samples of water because it was more sensitive and accurate, generally yielded the highest average median counts, and was simple and inexpensive. With this assay, a 100-ml sample of water, an agar medium containing divalent cations, and the host Escherichia coli C (ATCC 13706) were mixed in a single container, and the mixture was plated on ten 14-cm-diameter petri dishes. (Alexander-PTT)
W87-02890

COMPARISON OF CLARK'S PRESENCE-ABSENCE TEST AND THE MEMBRANE FILTER METHOD FOR COLIFORM DETECTION IN POTABLE WATER SAMPLES,
Drexel Univ., Philadelphia, PA. Dept. of Civil Engineering.
W. O. Pipes, H. A. Minnigh, B. Moyer, and M. A. Troy.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 3, p 439-443, September 1986. 5 tab, 6 ref. EPA Grant CR-810713.

Descriptors: *Bacterial analysis, *Filtration, *Coliforms, *Potable water, Bacteria, Fermentation, Detection methods, Contamination, Water quality, Membrane filters, Cost analysis, Drinking water, Water distribution systems.

A total of 2601 water samples from 6 different water systems were tested for coliform bacteria by Clark's presence-absence (P-A) test and by the membrane filter (MF) method. There was no significant difference in the fraction of samples positive for coliform bacteria for any of the systems tested. It was concluded that the 2 tests are equivalent for monitoring purposes. However, 152 samples were positive for coliform bacteria by the MF method but negative by the P-A test, and 132 samples were positive by the P-A test but negative by the MF method. Many of the differences for individual samples can be explained by random dispersion of bacteria in subsamples when the coliform density is low. However, 15 samples had MF counts > 3 and gave negative P-A results. The only apparent explanation for most of the results is that coliform bacteria were present in the P-A test bottles but did not produce acid and gas. Two other studies have reported more samples positive by the P-A test than by the MF method. (Author's abstract)
W87-02892

PHENOTYPIC CHARACTERISTICS OF COLIFORM AND NONCOLIFORM BACTERIA FROM A PUBLIC WATER SUPPLY COMPARED WITH REGIONAL AND NATIONAL CLINICAL SPECIES,
S. C. Edberg, V. Piscitelli, and M. Cartter.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 3, p 474-478, September 1986. 2 tab, 26 ref.

Descriptors: *Coliforms, *Bacterial analysis, *Water supply, *Municipal water, Reservoirs, Wells, Biofilm growth, Feces, Contamination, Bacteria, Water analysis, Temperature, Selectivity, Antibiotics, Escherichia coli, Enzymes.

Colonization of water distribution systems with Enterobacteriaceae other than Escherichia coli has been reported throughout the US and Canada. Because of biofilm growth and sloughing, the interpretation of elevated coliform counts in water systems can be difficult, especially since the isolation of non-E coli coliforms from water is not conclusive of fecal contamination. During the summer and fall of 1984, elevated total coliform bacteria counts were observed in the distribution system of a public water supply serving 350000 people in south central CT. As part of an investigation of possible health risks associated with the presence of bacteria in the water supply, bacterial isolates from the system were compared with isolates of the same species obtained from a large regional hospital and from a national compendium of clinical isolates. Characteristics isolated included phenotypic metabolic activity, antimicrobial susceptibilities to clinically used antibiotics, temperature tolerance at 44.5 C, and beta-glucuronidase activity. Environmental isolates lacked known plasmid-mediated characteristics, with the exception of 1 E coli isolate which showed some antibiotic resistance. Klebsiella pneumoniae, K. oxytoca, Enterobacter cloacae, and E agglomerans from all sources were temperature tolerant and yielded positive fecal coliform tests. Only E coli showed beta-glucuronidase activity. No single characteristic analyzed was sufficient to establish an organism as either environmental or clinical in origin. (Alexander-PTT)
W87-02894

DEVELOPMENT OF A METHOD FOR CONCENTRATION OF ROTAVIRUS AND ITS APPLICATION TO RECOVERY OF ROTAVIRUSES FROM ESTUARINE WATERS,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
V. C. Rao, T. G. Metcalf, and J. L. Melnick.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 3, p 484-488, September 1986. 1 fig, 5 tab, 19 ref.

Descriptors: *Water pollution sources, *Viruses, *Galveston Bay, *Water analysis, *Rotaviruses, *Estuaries, Contamination, Effluents, Chlorination, Sludge treatment, Water treatment facilities, Recreation, Shellfish, Bottom sediments, Colloids, Health hazards, Transport, Models, Suspended solids, Human diseases.

An advantage of these negatively charged filters is their ability to allow filtration of > 378 liters of moderately turbid water in 30-40 minutes. An improved method for detection of rotaviruses in water was used to monitor their presence in Galveston Bay. Samples adjusted to pH 3.5 and a final AlCl3 molarity of 0.001 were filtered through 25-cm pleated cartridge type filters of 3.0 and 4.5 micron porosity which are known to adsorb rotaviruses from sewage and estuarine water. Adsorbed virus was eluted with 1 liter of 10% tryptose phosphate broth, pH 9.5. Primary eluates were reconcentrated to a final volume of 10-20 ml by a simple and rapid magnetic iron oxide adsorption and elution procedure. Two per cent cassein at pH 8.5 effectively eluted rotavirus from iron oxide. A total of 21 of 72 water samples, suspended solids, fluffy sediments, and compact sediments collected in different seasons in Galveston Bay yielded rotaviruses. Recovery of rotaviruses varies from 119 to 1000 PFU/378 l of water, 1200 PFU/kg of compact sediment, 800 to 3800 PFU/378 l of fluffy sediment, and 1800 to 4980 PFU from suspended solids derived from 378 l of water based on immunofluorescent foci counts on cover slip cultures of fetal monkey kidney cells. (Alexander-PTT)
W87-02896

METHOD FOR DETERMINING VIRUS INACTIVATION DURING SLUDGE TREATMENT PROCESSES,
Zurich Univ. (Switzerland). Inst. of Virology.
F. Traub, S. K. Spillmann, and R. Wyler.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 3, p 498-503, September 1986. 3 fig, 2 tab, 49 ref. National Foundation (Switzerland) Grant 4.621.0.85.07.

Descriptors: *Viruses, *Wastewater analysis, *Inactivation, *Sludge digestion, *Anaerobic digestion, Wastewater treatment, Pathogens, Health hazards, Contamination, Decontamination, Enteroviruses, Inactivation rate, Adsorption, Microbial activity, Thermal stability, Temperature effects.

A sandwich device for the determination of virus inactivation in real-scale environments is an easy, fast, reliable method. The results obtained are reproducible, comparable and may be analyzed statistically. The method may also be suitable for inactivation studies of microorganisms, spores and parasite eggs. During sludge treatment processes, in situ, Bacteriophage f2 was adsorbed onto an electropositive membrane filter. The filter was then sandwiched between 2 polycarbonate membranes with pores smaller than the virus diameter. The sandwich was fixed in an open filter holder, and several such devices were connected before being exposed in sludge-digesting tanks. The device described prevented uncontrolled virus escape, but allowed direct contact of the various inactivating or stabilizing substances present in the environment tested with the virus adsorbed to the carrier membrane. After exposure to an environment, the surviving fraction of virus was eluted from the inner filter and determined by plaque counting. By using polycarbonate membranes without pores for sandwiching, the influence of temperature alone on virus inactivation could be measured. Thermophilic fermentation at 60 C and 65kPa pressure led to a bacteriophage f2 titer reduction of 3.5 log units/hour, whereas thermophilic digestion at 54.5 C titers increased 1.2 log units/h. During mesophilic digestion an inactivation rate of only 0.04 log units/h was observed. Under these latter conditions temperature had only a minor effect (19%) on virus inactivation, whereas at 54.5 C thermophilic digestion heat accounted for 32% of the total inactivation, and during thermophilic fermentation at 60 C temperature and pressure were 100% responsible for virus denaturation. (Alexander-PTT)
W87-02898

HUMIC ACID INTERFERENCE WITH VIRUS RECOVERY BY ELECTROPOSITIVE MICROPOROUS FILTERS,
Hadassah Medical School, Jerusalem (Israel). Environmental Health Lab.
N. Guttman-Bass, and J. Catalano-Sherman.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 3, p 556-561, September 1986. 1 fig, 6 tab, 29 ref. EPA Grant CR-806588-03-2.

Descriptors: *Poliovirus, *Waster treatment, *Humic acids, *Filtration, *Viruses, Recovery, Assay, Adsorption, Water quality, Contamination, Fulvic acids, Charged filters.

The effects of humic acids (HA) on poliovirus type I recovery from water by an electropositively charged microporous filter, Zeta Plus 60S (ZP) were explored. The HA interfered by preventing virus adsorption to the filters, and the interference increased as a function of HA filtered. HA decreased virus adsorption when filtered before the virus, but did not elute virus which had adsorbed to the filter. The effects on virus recovery were not due to alterations in virus titer or neutralizability. The addition of AlCl3, which improved recovery by electronegative filters in the presence of HA, did not aid in overall virus recovery by the ZP filters of HA. However, the salt and HA in combination improved virus adsorption and concurrently reduced virus elution efficiency. The addition of NaH2PO4 had no direct effect on virus recovery and did not alter the effect of HA. In an attempt to identify the components of HA responsible for the interference, humic materials were fractionated by size and the fractions were tested for interfering activity. Interference was not associated with special size fractions of the humic materials. (Alexander-PTT)
W87-02900

EFFECT OF ORGANOTINS ON FECAL POLLUTION INDICATOR ORGANISMS,
Massachusetts Univ. at Boston. Environmental Science Program.
For primary bibliographic entry see Field 5C.
W87-02901

NEW PROCEDURE FOR EXTRACTION OF AMMONIUM FROM NATURAL WATERS FOR 15N ISOTOPIC RATIO DETERMINATIONS,
Goeteborg Univ. (Sweden). Dept. of Botany.
J.-S. Selmer, and F. Sorensson.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 3, p 577-579, September 1986. 1 tab, 16 ref. Environmental Protection Board (Sweden) Grants 5339174-4; 5339175-1.

Descriptors: *Analytical methods, *Extraction, *Ammonium, *Nitrogen isotopes, Natural waters, Isotope techniques, Solvents, Field tests, Analytical methods, Elution, Evaporation, Contamination, Filters, Wastewater disposal, Nissan River, Sweden.

A new method for extracting ammonium from natural waters for 15N isotopic ratio determination uses the conversion of ammonium N into indophenol, which is then concentrated on an octadecylsilane column followed by elution and evaporation. The method shows accuracy and precision comparable to those of other methods described in the literature. Field experiments conducted the Swedish west coast indicated that ammonium regeneration ranged from 22 to 108 nmol N/l/hr. The regeneration rate was highest close to the mouth of the Nissan River and declined outward from land. The river water had a high content of particulate carbon and nitrogen and a high ammonium concentration because of sewage discharge. (Peter-PTT)
W87-02902

EVALUATION OF METHODS FOR PRESERVATION OF WATER SAMPLES FOR NUTRIENT ANALYSIS,
Geological Survey, Arvada, CO. Water Resources Div.
M. J. Fishman, L. J. Schroder, and M. W. Shockey.
International Journal of Environmental Studies IJEVAW, Vol. 26, No. 3, p 231-238, 1986. 5 tab, 7 ref.

Descriptors: *Preservation, *Nitrogen, *Phosphorus, *Sample preparation, *Nutrient analysis, *Water sampling, Temperature, Mercuric ions, Sulfuric acid, Chloroform, Ammonia, Organic nitrogen, Nitrites, Nitrates, Performance evaluation, Orthophosphates.

Mercuric ion, sulfuric acid, and chloroform were examined as preservatives for N and P species in water samples containing biologically active microorganisms. Chilling at 4 C without addition of a chemical preservative also was examined. Chilling alone at 4 C was an adequate preservation technique for 8-day storage of the water samples used in this study. For samples analyzed after 16-day storage, however, the addition of 40 mg/l of mercuric ion, plus chilling at 4 C, appeared to be the treatment preservation technique of choice. Neither chloroform nor sulfuric acid, coupled with chilling, were adequate as preservation techniques for all analytes determined during the 16-day study period. Analytes were organic N + ammonia as N, ammonia as N, nitrite + nitrate as N, nitrite as N, orthophosphate as P, and total P. (Rochester-PTT)
W87-03030

INDIRECT ATOMIC ABSORPTION DETERMINATION OF ANIONIC SURFACTANTS IN WASTEWATERS BY FLOW INJECTION CONTINUOUS LIQUID-LIQUID EXTRACTION,
Cordoba Univ. (Spain). Dept. of Analytical Chemistry.
M. Gallego, M. Silva, and M. Valcarcel.
Analytical Chemistry ANCHAM, Vol. 58, No. 11, p 2265-2269, September 1986. 4 fig, 4 tab, 25 ref.

Descriptors: *Indirect atomic absorption spectroscopy, *Chemical analysis, *Sample preparation, *Anionic surfactants, *Wastewater treatment, *Liquid-liquid extraction, *Wastewater analysis, Detergent-ion pairs, Detergents, Standard error, Sampling techniques, Methylene blue method.

A determination of anionic surfactants with an automatic continuous liquid-liquid extractor is reported. The method involves formation of the detergent-(1,10-phenanthroline-copper(II)) ion pair and extraction into methyl isobutyl ketone. The overall concentration of anionic surfactants can be determined indirectly by measurement of copper present in the organic layer by atomic absorption spectrometry. The optimum experimental conditions for determining detergents in the concentration range 0.1-5.0 microgram/ml are described. The relative standard deviation was 0.8%. The method is highly selective and free from the interference of nonionic surfactants and has been applied to the determination of anionic surfactants in wastewaters. The results show good agreement with those obtained by the classical methylene blue method. (Author's abstract)
W87-03048

PREDICTING STANDARD PH VALUES FOR REFERENCE BUFFER SOLUTIONS IN SOLVENT MIXTURES WITH WATER,
Milan Univ. (Italy). Dept. of Physical Chemistry and Electrochemistry.
P. Longhi, T. Mussini, and S. Rondinini.
Analytical Chemistry ANCHAM, Vol. 58, No. 11, p 2290-2292, September 1986. 1 tab, 21 ref.

Descriptors: *Hydrogen ion concentration, *Nonaqueous solvents, *Model studies, *Reference value standards, Solvents, Dielectric constant, Temperature, Prediction, Baseline studies, Physicochemical properties, Multilinear regression.

Analysis of available data of reference value standards, pH sub S, for pH measurements in different binary mixtures of nonaqueous solvents with water show that these values are satisfactorily accounted for in terms of such determinable physicochemical variables as solvent composition, dielectric constant, and temperature, together with the transfer activity coefficient upon the basic cells for the determination of the pH sub S standards. A procedure based on multilinear regression analysis is described that permits reliable pH sub S values to predicted for other solvents or solvent mixtures from knowledge of the relevant values of the above variables. (Author's abstract)
W87-03049

TWO-METHOD VERIFICATION OF HYDROGEN PEROXIDE DETERMINATIONS IN NATURAL WATERS,
Maryland Univ., College Park. Dept. of Chemistry.
R. J. Kieber, and G. R. Helz.
Analytical Chemistry ANCHAM, Vol. 58, No. 11, p 2312-2315, September 1986. 4 fig, 2 tab, 28 ref.

Descriptors: *Hydrogen peroxide, *Water analysis, *Iodometric titration, *Amperometry, Enzymes, Iodine, Iodides, Fluorometry, Salinity, Standardization.

An iodometric tritation was investigated for verifying H2O2 determinations in natural water matrices. Hydrogen peroxide oxidizes iodide to iodine at pH 4 in the presence of (NH4)6Mo7O24.4H2O. The I2 that is generated reacts with an added spike of phenylarsine oxide, the excess of which is titrated with a standardized iodine titrant to an amperometrically determined end point. The difference between titrations with and without the enzyme catalase is proportional to the H2O2 concentration. The detection limit is estimated at 0.02 micromolar. A previously described independent fluorometric method is in excellent agreement with the present method when applied to fresh and saline natural waters containing 0.05-5.00 micromolar H2O2. Demonstration of such agreement can be used for verification purposes in the absence of certified standards. (Author's abstract)
W87-03050

SPECIATION OF MANGANESE IN FRESHWATERS,
Queensland Univ., Brisbane (Australia). Dept. of Chemistry.
For primary bibliographic entry see Field 2K.
W87-03051

SPECTROPHOTOMETRIC DETERMINATION OF CHROMIUM IN WASTE WATER AND SOIL,
Hangzhou Univ. (China). Dept. of Chemisry.
W.-B. Qi, and L.-Z. Zhu.
Talanta TLNTA2, Vol. 33, No. 8, p 694-696, August 1986. 1 fig, 3 tab, 7 ref.

Descriptors: *Wastewater analysis, *Sample preparation, *Soil analysis, *Chromium, *Spectrophotometry, Cetyltrimethylammonium bromide, Beer's Law, Copper, Iron, Aluminum, Potassium fluoride, Tartrates, Ions, Heavy metals, Pollutants, Diphenylcarbazone.

The reaction of Cr(VI) with o-nitrophenylfluorone (NPF) in the presence of cetyltrimethylammonium bromide (CTMAB), forming a purplish red complex at pH 4.7-6.6 by heating at 50 C for 10 min, was investigated. The composition of the complex is 1:2:2 (Cr(VI):NPF:CTMAB) and the wavelength of maximum absorbance is 582 nanometer. The molar absorptivity is 111000 liter/mole/cm. Beer's law is obeyed up to a Cr(VI) concentration of 0.2 microgram/ml. The interference of several ions, including Cu(2+), Fe(3+), and Al(3+), is eliminated by the addition of a masking mixture containing KF, trans-1,2-diaminocyclohexanetetraacetic acid, and tartrate. The present reaction has been employed to determine Cr(VI) in wastewater in the presence of at least three times as much Cr(III). The results are satisfactory compared to diphenylcarbazone. Total chromium in wastewater and in soil also can be determined by the method described. (Rochester-PTT)
W87-03052

DECLINE OF THE GASTROPOD NUCELLA LAPILLUS AROUND SOUTH-WEST ENGLAND: EVIDENCE FOR THE EFFECT OF TRIBUTYLTIN FROM ANTIFOULING PAINTS,
Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Biology.
For primary bibliographic entry see Field 5C.
W87-03053

DETERMINATION OF HALOGENATED SOLVENT RESIDUES IN WATER, WASTE WATER, FEEDING-STUFFS, AND FOOD, (BESTIMMUNG HALOGENIERTER LOSUNGSMITTELRUCKSTANDE IN WASSER, ABWASSER, FUTTER- UND LEBENSMITTELN),
Lebensmittelversuchsanstalt, Vienna (Austria). Forschungsinstitut der Ernaehrungswirtschaft.
W. Pfannhauser, and A. Thaller.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 322, No. 2, p 220-222, September 1985. 4 fig, 3 tab, 5 ref.

Descriptors: *Gas chromatography, *Pesticides, *Polychlorinated biphenyls, Water analysis, Wastewater analysis, Feedstuffs, Food contamination, Halogenated solvents, Sample preparation, Extraction.

A method for the determination of 16 different halogenated solvent residues by gas chromatography is described. With this procedure, it is possible to determine chlorinated pesticides and polychlorinated biphenyls simultaneously. Problems in the clean-up and extraction procedure are dealt with, especially with dried material. Examples for the analysis for residues in drinking water, waste water, and feeding-stuffs and the carry-over to food are given. (Author's abstract)
W87-03086

DIRECT DETERMINATION OF CD, CU AND NI IN THE ELBE RIVER ESTUARY WITH ZEEMAN AAS AND MATRIX MODIFICATION (DIREKTBESTIMMUNG VON CD, CU AND NI IM ELBEASTUAR MIT HILFE DER ZEEMAN-ATOMABSORPTIONSSPEKTROSKOPIE UND MATRIXMODIFIKATION),
Technische Univ. Hamburg-Harburg (Germany, F.R.). Arbeitsbereich Umweltschutztechnik.
W Calamano, W. Ahlf, and T. Schilling.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 323, No. 8, p 865-868, April 1986. 4 fig, 3 tab, 4 ref.

Descriptors: *Cadmium, *Copper, *Nickel, *Elbe River estuary, *Zeeman atomic absorption spectroscopy, *Matrix modification, Seawater, Water analysis, Detection limits, Heavy metals, Concentration.

Procedures for the direct determination of Cd, Cu and Ni concentrations in the Elbe River estuary are presented, based on Zeeman background correction and matrix modification. Investigations showed good results in the microgram/liter (ug/l) range. Detection of Ni in seawater was impossible without matrix modification. The advantages of direct determination are useful detection limits, high precision, and short time in analysis. The detection limits were 0.1 ug/l for Cd, and 1 ug/l for Cu and Ni. (Author's abstract)
W87-03087

HPLC ANION EXCLUSION METHOD FOR FLUORIDE DETERMINATIONS IN COMPLEX EFFLUENTS,
Smith Kline and French Labs., Philadelphia, PA.
R. E. Hannah.
Journal of Chromatographic Science JCHSBZ, Vol. 24, No. 8, p 336-339, August 1986. 6 fig, 2 tab, 6 ref.

Descriptors: *High performance liquid chromatography, *Ion chromatography, *Wastewater analysis, *Polymeric liquid chromatography, *Organic acid analysis, *Conductivity, *Fluorides, Chlorides, Sulfates, Ions, Effluents, Sample preparation, Detection limits.

A single-column nonsuppressed ion chromatographic (IC) method is described for the determination of fluoride in wastewater effluents and aqueous process streams. The method utilizes a polymeric liquid chromatography column, commonly used for organic acid analysis and conductivity detection. Fluoride is determined at low ppm (mg/l) levels in the presence of high concentrations of potential ionic interferents such as chloride and sulfate, utilizing ion exclusion as the principal separation mechanism. The limit of detection is 0.2 ppm fluoride with a working linear dynamic range of 0.2- to 100-ppm fluoride. Both ion exchange and ion exclusion techniques were evaluated during the course of the study. Only nonsuppressed detection modes were employed due the unavailability of a suppressor system. (Author's abstract)
W87-03094

HALOGENATED PHENOLS IN WATER AT FORTY CANADIAN POTABLE WATER TREATMENT FACILITIES,
Health and Welfare Canada, Ottawa (Ontario). Monitoring and Criteria Div.
For primary bibliographic entry see Field 5F.
W87-03112

LIQUID CHROMATOGRAPHIC DETERMINATION OF FLURIDONE AQUATIC HERBICIDE AND ITS METABOLITE IN FISH AND CRAYFISH,
Lilly (Eli) and Co., Indianapolis, IN. Lilly Research Lab.
S. D. West, and E. W. Day.
Journal Association of Official Analytical Chemists JANCA2, Vol. 69, No. 5, p 856-859, 1986. 3 fig, 2 tab, 14 ref.

Descriptors: *Fluridone, *Sample preparation, *Bioaccumulation, *Fate of pollutants *Fish, *Crayfish, *Chemical analysis, *Tissue analysis, Aquatic herbicides, Liquid-liquid partitioning, Column chromatography, Reverse-phase liquid chromatography.

A residue method for determination of the aquatic herbicide fluridone (1-methy-3-phenyl-5-(3-(trifluoromethyl)phenyyl)-4(1H)-pyridinone) and its metabolite (1-methyl-3-(4-hydroxyphenyl)-5-(3-(trifluoromethyl)phenyl 4(1H)-pyridinone) in fish and crayfish tissues is described. Both compounds are extracted from tissues with methanol, and the extracts are subjected to acidic hydrolysis to release conjugated forms of fluoridone and the metabolite. Sample extracts are purified by liquid-liquid partitioning and Florisil Sep-Pak(R) column chromatography. Both compounds are separated and measured by reverse-phase liquid chromatography with UV detection at 313 nm. In the absence of interfering peaks, the method has a detection limit of approximately 0.04 ppm of either compound. Overall, recoveries averaged 96% for fluridone and 78% for the metabolite for all tissue types combined. (Author's abstract)
W87-03113

INTERLABORATORY COMPARISON OF ANALYSES FOR HEAVY METALS IN CLAM TISSUE,
Department of Fisheries and Oceans, Winnipeg (Manitoba). Freshwater Inst.
M. R. Hendzel, B. W. Fallis, and B. G. E. deMarch.
Journal Association of Official Analytical Chemists JANCA2, Vol. 69, No. 5, p 863-868, 1986. 7 tab, 13 ref.

Descriptors: *Comparison studies, *Clam tissues, *Heavy metals, *Oyster tissues, *Lead, *Cadmium,

*Copper, *Zinc, *Tissue analysis, Reproducibility, Variability, Coefficient of variation, Pollutant identification, Performance evaluation, Analytical methods.

Reproducibility of analyses for Pb, Cu, Cd, and Zn was compared among 10 laboratories, each of which analyzed two samples of freeze-dried clam tissue and 1 disguised sample of National Bureau of Standards oyster tissue. Interlaboratory variations were observed for all metals, but the methods yielded reproducible data for Cu and Zn, with average interlaboratory coefficients of variation (CVs) of 15 and 11%, respectively. The performance of methods used for Cd and, more so, for Pb was less than satisfactory. Cd levels in the three samples ranged from about 0.7 to to 3.7 ppm, with an average interlaboratory CV of 24%. Pb levels in the 3 samples were about 0.5 ppm, with an interlaboratory CV of 68%. Some laboratories' results were consistently high or low, but data were insufficient to relate these trends to one particular variable. Results from this study were compared with 5 other studies published since 1980. CVs from all studies were comparable for samples with similar metal concentrations. (Author's abstract)
W87-03114

FLAME ABSORPTION SPECTROSCOPIC DETERMINATION OF CADMIUM, COPPER, IRON, LEAD, AND ZINC IN MUSSELS,
Instituto de Agroquimica y Tecnologia de Alimentos, Valencia (Spain).
M. Solchaga, R. Montoro, and M. De La Guardia.
Journal Association of Official Analytical Chemists JANCA2, Vol. 69, No. 5, p 874-876, 1986. 1 fig, 2 tab, 13 ref.

Descriptors: *Flame absorption spectroscopy, *Heavy metals, *Cadmium, *Copper, *Iron, *Lead, *Zinc, *Mussels, Tissue analysis, Pollutant identification, Nitric acid extraction, Atomic absorption spectroscopy, Coefficient of variation, Oyster tissues, Sample preparation, Analytical methods.

A rapid method for the determination of Cd, Cu, Fe, Pb, and Zn in mussel samples. The elements are extracted with concentrated nitric acid in borosilicate glass tubes at 90 C for 1 hr, and determined by atomic absorption spectroscopy. Detection limits for a 300 mg sample corresponded to 0.3 microgram (ug) Cd/g, 0.7 ug Cu/g, 33 ug Fe/g, 0.7 ug Pb/g, and 6 ug Zn/g. The coefficient of variation for 20 independent analyses was 7% for Cd, 7% for Cu, 6% for Fe, 14% for Pb, and 8% for Zn. Recoveries were 107 + or - 3% for Cd, 90 + or - 3% for Cu, 94 + or - 1% for Fe, 90 + or - 5% for Pb, and 96 + or - 3% for Zn. The accuracy of the method was determined by analyzing National Bureau of Standards oyster tissues. (Author's abstract)
W87-03115

MONITORING POLLUTION,
T. C. Elliott.
Power POWEAD, Vol. 130, No. 9, p S1-S16, September 1986. 33 fig.

Descriptors: *Air pollution, *Water pollution, Monitoring, Environmental Protection Agency, Weather, Environmental protection, Powerplants, Colorimetry, Conductivity, Dissolved oxygen, Hydrogen ion conentration, Turbidity, Chlorine, Influent water, Effluent streams.

Several aspects of air and water pollution monitoring were reported. The impact of the Environmental Protection Agency's continuous emissions monitoring program was discussed. Principles and improvements in gas analyzer design were examined and flue gas sampling, analysis and monitoring techniques were explained. The importance of weather data in monitoring ambient pollution was emphasized. The diversity and complexity of water pollution monitoring was discussed in relation to powerplant operations. Monitoring techniques such as colorimetry and conductivity were reviewed and methods for measuring dissolved oxygen, pH, turbidity and chlorine levels to assess the condition of powerplant influent water and receiving water were described. The use of special purpose analysis equipment was also discussed. (Michael-PTT)
W87-03117

DISSOLVED ORGANIC MATTER IN ANOXIC PORE WATERS FROM MANGROVE LAKE, BERMUDA,
Geological Survey, Reston, VA.
W. H. Orem, P. G. Hatcher, E. C. Spiker, N. M. Szeverenyi, and G. E. Maciel.
Geochimica et Cosmochimica Acta GCACAK, Vol. 50, No. 4, p 609-618, April 1986. 4 fig, 3 tab, 45 ref.

Descriptors: *Decomposing organic matter, *Interstitial water, *Bermuda, Sediments, Sulfates, Alkalinity, Phosphates, Ammonia, Organic compounds, Molecular structure.

Dissolved organic matter and dissolved inorganic chemical species in anoxic pore water from Mangrove Lake, Bermuda were studied to evaluate the role of pore water in the early diagensis of organic matter. Dissolved sulfate, titration alkalinity, phosphate and ammonia concentration versus depth profiles were typical of many nearshore clastic sediments and indicated sulfate reduction in the upper layer of sediment. Dissolved organic matter in pore water was primarily composed of large molecules. This was concentrated by ultrafiltration and studied using elemental and stable carbon isotope analysis and high resolution 13C nuclear magnetic resonance and infrared spectroscopy. Results indicated that the material had a predominately polysaccharide-like structure and contained a large amount of oxygen-containg groups. Nuclear magnetic resonance spectra of this material resembled those of organic matter in surface sediments of Mangrove Lake. High-molecular-weight organic matter in pore waters represent the partially degraded, labile organic components of the sedimentary organic matter. Pore waters serve as a conduit for removing these labile organic components from sediments. The more refractory component are selectively preserved in sediments as humic substances. (Author's abstract)
W87-03136

ACYCLIC ARCHAEBACTERIAL ETHER LIPIDS IN SWAMP SEDIMENTS,
University of South Florida, St. Petersburg. Dept. of Marine Science.
E. G. Pauly, and E. S. Van Vleet.
Geochimica et Cosmochimica Acta GCACAK, Vol. 50, No. 6, p 1117-1125, June 1986. 5 fig, 4 tab, 59 ref.

Descriptors: *Swamp sediments, *Lipids, Methane bacteria, Lake Maggiore, Organic matter, Carbon dioxide, Acetates, Methane.

Acyclic phytanyl diether glycerol and biphytanyl ether lipids were quantified in two modern swamp sediment cores taken near Lake Maggiore, FL. Methanogenic bacteria are the only known source organisms which can inhabit swamp sediments. Variations in relative abundance between these lipids may reflect taxonomic changes in methanogen populations or their stage of growth. Maxima in methanogen lipid concentrations coincided with local maxima of 13C of organic matter, which was possibly the result of a pool effect on CO2 or acetate. Methane production estimates calculated from lipid concentrations in these swamped sediments were consistent with published methane fluxes. (Author's abstract)
W87-03141

PARTITIONING OF 7 BERYLLIUM IN FRESH WATER,
National Oceanic and Atmospheric Administration, Ann Arbor, MI. Great Lakes Environmental Research Lab.
N. Hawley, J. A. Robbins, and B. J. Eadie.
Geochimica et Cosmochimica Acta GCACAK, Vol. 50, No. 6, p 1127-1131, June 1986. 4 fig, 13 ref.

Descriptors: *Beryllium, Tracers, Adsorption, Sedimentation, *Pollutant identification, Sediment concentration, Partition coefficient.

Field observations and experimental measurements of the partitioning coefficient of 7Be in fresh water demonstrated that it varies inversely with the solids concentration at environmental values. This behavior is similar to that of other metals and organic pollutants, which indicates the potential usefulness of 7Be as a pollutant tracer in the water column. The wide range in the adsorption percentage of 7Be by solids at a 50% concentration indicates that changes in sediment concentration over the area and period of interest must be monitored in order to use 7Be to either measure total sedimentation rates or trace lateral sediment movement. A wide data scatter at both high and low solids concentrations suggests that other factors may affect the partitioning coefficient, and thus application of the present study to other systems might be risky. At high solids concentrations, over 90% of 7Be is associated with the solid phase, so 7Be might be a useful tracer of reworking rates in bottom sediments. 7Be has a slightly greater affinity for the solid phase in fresh water than in seawater. (Author's abstract)
W87-03142

TRITIUM CORRECTED 14C AND ATMOSPHERIC NOBLE GAS CORRECTED 4HE APPLIED TO DEDUCE AGES OF MIXED GROUNDWATERS: EXAMPLES FROM THE BADEN REGION, SWITZERLAND,
Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Isotope Research.
E. Mazor, F. C. Jaffe, J. Flack, and J. D. Dubois.
Geochimica et Cosmochimica Acta GCACAK, Vol. 50, No. 8, p 1611-1618, August 1986. 4 fig, 3 tab, 40 ref.

Descriptors: *Carbon radioisotopes, *Water analysis, *Tritium, *Helium radioisotopes, *Groundwater dating, *Switzerland, Radioactive dating.

Tritium and 14C radioisotope values were used identify the ages of mixed recent and old groundwaters in the Baden and Yverdon regions of Switzerland. The age of an old endmember was deduced by correcting the measured 14C value using tritium. 4He was used as a second semi-quantitative age indicator by overlapping and extending beyond the 14C range. In this case, tritium was used to derive 4He concentration in the old endmember and atmospheric noble gases were used to check He retention and correct for losses. Corrected 14C and 4He values can be applied to check concordance between computed ages in mixed and unmixed groundwaters. Discordant ages signal the activity of secondary processes while concordant ages indicate that basic dating premises have not been violated. (Michael-PTT)
W87-03147

NATURE OF PARTICULATE ORGANIC MATTER IN THE RIVER INDUS, PAKISTAN,
Hamburg Univ. (Germany, F.R.). Geologisch-Palaeontologisches Inst. und Museum.
V. Ittekkot, and R. Arain.
Geochimica et Cosmochimica Acta GCACAK, Vol. 50, No 8, p 1643-1653, August 1986. 8 fig, 3 tab, 56 ref.

Descriptors: *Organic matter, *Indus River, *Pakistan, Suspended sediments, Amino acids, Sugars, Biodegradation, Sediment discharge, Sediment load, Organic carbon, Marine sediments, River systems, Temporal distribution.

Suspended sediments from the Indus River were analyzed for particulate organic carbon (POC) and its constituent fractions such as amino acids, amino sugars and sugars to determine the nature of organic matter at high and low sediment discharge periods. POC percentage decreased with increasing suspended matter concentrations which suggested dilution of organic matter by mineral matter. Concentrations of amino acids, amino sugars and sugars varied as did their relative contributions to POC which were high during low sediment dis-

charge and low during high sediment discharge. Suspended sediments associated with high sediment discharge periods were characterized by low ratios of amino acids to amino sugars. This factor and the relative distribution pattern of monosaccharides such as galactose, arabinose, mannose and xylose indicated that differences in sources and processes influenced POC transport in the Indus River. These result in transport of biodegraded organic matter during high sediment discharge periods which is typical of other major rivers in this region with depositional centers in deep sea areas. The high sediment loads of these rivers could contribute from 8 to 11% of the global annual organic carbon burial in marine sediments. (Author's abstract)
W87-03148

L37C-L35C VARIATIONS IN A DIFFUSION-CONTROLLED GROUNDWATER SYSTEM,
Waterloo Univ. (Ontario). Dept. of Earth Sciences.
D. S. Desaulniers, R. S. Kaufmann, J. A. Cherry, and H. W. Bentley.
Geochimica et Cosmochimica Acta GCACAK, Vol. 50, No. 8, p 1757-1764, August 1986. 7 fig, 28 ref.

Descriptors: *Chlorine isotopes, *Diffusion, *Groundwater, Ontario, Glacial aquifers, Isotope studies, Enrichment, Sensitivity analysis, Kinetics, Simulation analysis, Interfaces, Groundwater movement, History, Mathematical models.

A study to determine whether or not chlorine isotopes in groundwater exhibited isotope enrichment effects due to diffusion during Late Pleistocene and Holocene times was conducted on glacial till deposits in southwestern Ontario. High precision 137C measurements were performed on groundwater samples from two sites exhibiting gradual increases in Cl(-) versus depth. The measurements were compared to theoretical predictions of isotopic enrichment produced by diffusion. Vertical profiles showed a gradual enrichment in 135C relative to 137C with increasing distance upward from the bedrock-till interface. A mathematical solute transport model that incorported the effects of kinetic isotope partitioning was used to simulate 137C distributions. Sensitivity analysis indicated that model results were affected by groundwater velocity, the isotope enrichment factor and diffusion times. Agreement between simulated and observed Cl(-) isotope profiles was obtained using groundwater velocity of zero, an isotopic enrichment factor of 1.0012 and diffusion times ranging from 14,000 to 16,000 years. It is concluded that isotopic enrichment of 135C is caused by upward diffusion of 15,000 years which is consistent with what is known about the Quaternary history of this area. (Author's abstract)
W87-03149

FLUOROMETRIC DETERMINATION OF NITRITE IN NATURAL WATERS WITH 3-AMINONAPHTHALENE-1,5-DISULPHONIC ACID BY FLOW-INJECTION ANALYSIS,
Okayama Univ. (Japan). Dept. of Chemistry.
S. Motomizu, H. Mikasa, and K. Toei.
Talanta TLNTA2, Vol. 33, No. 9, p 729-732, September 1986. 1 fig, 3 tab, 10 ref.

Descriptors: *River water, *Seawater, *Sample preparation, *Water analysis, *Fluorometry, *Nitrites, *Fluorometry, *Flow injection analysis, Pollutant identification, Spectrophotometry, Seto Inland Sea, Kojima Lake, Japan.

Nitrite in river and seawater was determined fluorometrically by flow injection analysis. In acidic medium, nitrite was reacted with 3-aminonaphthalene-1,5-disulfonic acid (C-acid) to form the diazonium salt, which was converted into the fluorescent azoic acid salt in an alkaline medium. The carrier stream receiving injected sample was distilled water. The reagent solution stream, which contained C-acid, disodium ethylene diaminetetraacetate (disodium EDTA) and hydrochloric acid, was mixed with the carrier stream in a 13-m length of 0.5 mm bore Teflon tubing maintained at 90 C. After passing through the mixing coil, the stream was mixed with an alkaline solution. The fluorescence intensity (excitation at 365 nanometer (nm)) was measured at 470 nm. The detection limit (signal/noise = 3) was 1 x ten to the -9th power Molar (14 nanogram/l nitrite-N) and the relative standard deviation of 10 injections of 0.000001 Molar nitrite was 0.4%. Analyses can be done at a rate of 45/hr. Results with the present method are compared to spectrophotometric determinations of nitrite in waters of three rivers, Seto Inland Sea, and Kojima Lake (Japan). (Rochester-PTT)
W87-03172

DETERMINATION OF ORGANICALLY-ASSOCIATED TRACE METALS IN ESTUARINE SEA-WATER BY SOLVENT EXTRACTION AND ATOMIC-ABSORPTION SPECTROMETRY,
Hiroshima Univ. (Japan). Faculty of Integrated Arts and Sciences.
K. Hayase, K. Shitashima, and H. Tsubota.
Talanta TLNTA2, Vol. 33, No. 9, p 754-756, September 1986. 1 tab, 13 ref.

Descriptors: *Extraction, *Sample preparation, *Heavy metals, *Trace metals, *Nickel, *Copper, *Molybdenum, *Managanese, *Cadmium, *Lead, *Seto Inland Sea, *Atomic absorption spectroscopy, *Hiroshima Bay, *Water analysis, Seawater, Pollutant identification, Chelation, Dissolved organic matter, Japan.

Chloroform extraction of trace metals (Ni, Cu, Mo, Mn, Cd, and Pb) in estuarine seawater was studied at pH 8 and pH 3, on the basis that the metals would be associated with dissolved organic matter (DOM), whih has recently been characterized by reversed-phase liquid chromatography. Ni, Cu, Mo, and Mn were extracted more at pH 8 than at pH 3. Cd and Pb were not associated with the DOM at either pH. The percentage of the total dissolved trace metals in seawater (from Hiroshima Bay in the Seto Inland Sea, Japan) associated with DOM varied from 0 to 14%. The metals extracted into chloroform at pH 8 were assumed to be associated with neutral or weakly basic DOM, whereas at pH 3 they could be associated with either the neutral (or weakly basic) DOM or two types of acidic DOM. (Author's abstract)
W87-03173

CHARACTERIZATION OF SEDIMENT CONTAMINATION UTILIZING BIOASSAY/BIACCUMULATION TESTING,
Corps of Engineers, New York. New York District.
For primary bibliographic entry see Field 5B.
W87-03255

DIFFERENT TECHNIQUES FOR THE COMPUTATION OF RIVER NUTRIENT LOADS (METHODOLOGIES DE QUANTIFICATION DES FLUX DE NUTRIMENTS EN RIVIERE),
Centre National du Machinisme Agricole, du Genie Rural, des Eaux et des Forets, Lyon (France).
For primary bibliographic entry see Field 2H.
W87-03298

REAL TIME WATER QUALITY FORECASTING MODELS BASED ON THE WATER QUANTITY/QUALITY RELATIONSHIP,
Vrije Univ., Brussels (Belgium). Lab. of Hydrology.
J. L. Marivoet.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 395-404, 3 fig, 8 tab.

Descriptors: *Water quality control, *Model studies, *Water supply, Water quality standards, Forecasting, Rivers, River flow, Rainfall-runoff relationships.

For the real time management of a safety reservoir used in drinking water supply, short term forecasts of the water quality in the River Meuse are needed. Four methods for forecasting fluoride and chloride concentrations are compared. The first model consists of a simple ARMA model forecasting future concentrations from the last measured concentrations. The second and third methods are based on dilution relationships. A transfer function-noise model, with the reciprocal of the river flow as input and the concentrations as output, is proposed as a fourth method. A simple rainfall-runoff model is introduced to forecast future runoffs. The combined transfer function-noise model gives satisfactory results for short term forecasts of fluoride and chloride concentrations. For long term forecasts dilution models are preferred. If rainfall information is available a simple rainfall-runoff model enables improvement in the performance of the forecasting model. (See also W87-03272) (Lantz-PTT)
W87-03304

MEASURING SUSPENDED SEDIMENT IN SMALL MOUNTAIN STREAMS,
Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.
R. B. Thomas.
General Technical Report PSW-83, July 1985. 9 p, 1 fig, 2 tab, 15 ref.

Descriptors: *Sampling, *Sediment load, *Suspended sediments, *Water quality, *Monitoring, Streams, Sediment transport, Channel morphology, Water sampling, Data collections, Flow profile, Flow pattern.

Measuring suspended sediment concentration in streams provides a way of monitoring the effects of forest management activities on water quality. Collecting data on suspended sediment is an act of sampling. The nature of the delivery process and the circumstances under which data are collected combine to produce highly variable results that are difficult to analyze and interpret. Data-collection stations are set up to compare one set of measurements to another. They should be located with regard to channel morphology. Deciding when to measure suspended sediment is a major problem in carrying out most studies. Concentration depends heavily on streamflow discharge, which can be used to allocate sampling resources to appropriate flow levels. Restrictions in budgets and technical concerns have fostered the increased use of automatic pumping samplers in measuring suspended sediment. (Author's abstract)
W87-03324

5B. Sources Of Pollution

METABOLICAL ACTIVITY OF BACTERIA IN GEOTHERMAL SPRING-WATERS DATING FROM DOGGER AND TRIAS PERIODS IN THE BASSIN PARISIEN, (ACTIVITES METABOLIQUES DES BACTERIES DES EAUX GEOTHERMALES DU DOGGER ET DU TRIAS DU BASSIN PARISIEN),
Aix-Marseille-1 Univ. (France).
S. Daumas, O. Goyeneche, and A. Bianchi.
Comptes Rendus de l'Academie des Sciences (Series 3) CHDDAT, Vol. 301, No. 6, p 295-297, July 1985. 2 tab, 6 ref.

Descriptors: *Geothermal resources, *Thermal springs, *France, *Drilling, *Thermophilic bacteria, *Paris Basin, *Groundwater pollution, Sodium chloride, Isotopic tracers, Methane bacteria, Bacterial analysis, Metabolites.

Autotrophic and heterotrophic microbial activity measurements in the groundwaters of four geothermic sites dating from Dogger and Trias periods that make up the Bassin Parisien, show that the main activity is chemolithotrophic. The microflora responsible for this activity is essentially thermophile. Though adapted to the conditions of the aquifers, it could have an autochthonous origin. The heterotrophic bacteria found in the aquifers were probably introduced by contamination during drilling. These results are based on a laboratory study of well samples in which the relative rates of uptake of C-14 labeled substrates - glucose or

H2C03 - were compared. Measurements were made at 20 C and at 65 C. (Airone-PTT)
W87-02562

DISTRIBUTION OF ANIONIC SURFACTANTS IN THE WATER COLUMN OF THE GULF OF FOS-SUR-MER, (DISTRIBUTION DES DETERGENTS ANIONIQUES DANS LA COLONNE D'EAU DU GOLFE DE FOS-SUR-MER),
Centre d'Oceanologie de Marseille (France).
R. Siron, and G. Giusti.
Comptes Rendus de l'Academie des Sciences (Series 3) CHDDAT, Vol. 301, No. 6, p 313-315, July 1985. 2 tab, 14 ref.

Descriptors: *Detergents, *Surfactants, *Path of pollutants, *Coastal waters, *Rhone River, *France, *Groundwater pollution, Sediments, Anions, Urbanization, Industrial wastes, Hydrocarbons, Water pollution sources.

The high concentrations in total anionic surfactants found in the whole water column, added to their relatively constant level, show the high degree of contamination to which the site is subjected. The surfactant concentrations also partly explain the high levels of dissolved hydrocarbons found in the area. The principal origin of this pollution is the dilution from the Rhone River, by inputs of surfactants which are concentrated in superficial waters, or by dissolution of trapped surfactants from the sediment into the water column. (Author's abstract)
W87-02563

OVERVIEW OF PCB POLLUTION AND ITS BEHAVIOR IN SEINE RIVER, (APERCU SUR LA POLLUTION PAR LES P.C.B. (POLYCHLOROBIPHENYLES) EN SEINE, ET SON COMPORTEMENT),
Paris-6 Univ. (France). Inst. d'Hydrologie et de Climatologie.
M. Chevreuil, A. Chesterikoff, and R. Letolle.
Comptes Rendus de l'Academie des Sciences (Series 2) CHDCAQ, Vol. 302, No. 14, p 877-882, April 1986. 4 fig, 1 tab, 8 ref.

Descriptors: *Water pollution sources, *Polychlorinated biphenyls, *France, *Seine River, *Sediments, Surface water, Chlorinated hydrocarbons, Regulations, Seasonal variation, Low flow, Potable water, Adsorption.

The contamination of the Seine River by PCBs was studied in June 1984 before the low water mark and in October before the first flood. Two hundred km of the river and its tributaries were studied, both the water and sediments. Variation of local concentrations shows that direct inputs continue, and that most of the flux occurs in solution and is especially high at the start of the low water period. This last point is particularly important since it is during low water that the river courses are most heavily relied on as a source of potable water. Pollution is particularly high below Paris and the mean concentration for sediments reaches 3800 ppb. In sediments PCBs are preferentially adsorbed onto matter rich in organics. (Airone-PTT)
W87-02564

ADSORPTION OF SELECT PHENOL DERIVATIVES BY DOLOMITE,
Argonne National Lab., IL. Chemical Technology Div.
B. A. Hudson-Baruth, and M. G. Seitz.
Environmental Pollution (Series B) EPSPDH, Vol. 11, No. 1, p 15-28, 1986. 2 fig, 7 tab, 16 ref.

Descriptors: *Phenols, *Groundwater pollution, *Path of pollutants, *Dolomite, Aquifers, Degradation, Leaching, Cleanup.

The behavior of six phenols in dolomite aquifers was investigated in laboratory experiments: 4-chloro-m-cresol, 2,4-dimethylphenol, 2,4-dinitrophenol, 4-nitrophenol, pentachlorophenol, and 2,4,6-trichlorophenol. The objective of the research was to establish the migration of selected phenol compounds in waters that move through dolomite rock, a common groundwater aquifer in many regions. The extent that phenols partitioned between groundwater and dolomite was established. The partitioning is indicative of how the phenol might adsorb onto rock or move with water flowing through an aquifer. The migration predicted from the partition was compared with migration observed for two phenols when they were pumped through cores of rock. To compare with the characteristics of dolomite, commercially available chemical sorbents were also examined with regard to their cleanup of phenol-contaminated groundwater. Little, if any, of the phenols adsorb onto dolomite at temperatures of 5 and 22 C and at concentrations from 0.1 to 10 mg/liter. Pentachlorophenol adsorbs most strongly, with as much as 22% adsorbing from groundwater onto dolomite. No processes of phenol degradation were detected, with some experiments lasting 21 days. Phenols dispersed in an area where they can leach and contaminate dolomite groundwater aquifers would pose a threat to human health and the environment. In contrast to dolomite, chemical sorbents strongly adsorb the phenols and could be used for groundwater cleanup. (Author's abstract)
W87-02583

CONTROL OF THE METHYLATION PROCESS IN A MERCURY-POLLUTED AQUATIC SEDIMENT,
Cook Coll., New Brunswick, NJ. Dept. of Biochemistry and Microbiology.
M. Berman, and R. Bartha.
Environmental Pollution (Series B) EPSPDH, Vol. 11, No. 1, p 41-53, 1986. 1 fig, 9 tab, 13 ref.

Descriptors: *Methylation, *Mercury, *Sediments, *Methylmercury, *Berry's Creek, *New Jersey, Hydrogen ion concentration, Redox potential, Biota, Sulfides, Dredging, Estuaries, Industrial wastes.

The prevailing physico-chemical and microbial status of Berry's Creek, New Jersey, was surveyed. The reasons for the abnormally low methylation activity were assessed; whether it was due to the absence of the appropriate microorganisms or to the chemical form of the polluting Hg. Past refining activity deposited up to 1000 mg/kg total Hg in sediments of the estuarine Berry's Creek, yet methylmercury levels in the sediment were below 10 microgram/kg. The factors that control Hg methylation in this low-salinity anaerobic sediment were analyzed. When compared to a normally methylating control sediment, no significant differences were found in pH, redox potential, microbial counts and methylating potential, but sulfide concentrations in Berry's Creek sediment were unusually high. A causal connection between the elevated sulphide levels and low Hg methylation activity was established. In its current state, the contaminant poses little danger to biota, but a significant decline in sediment sulphide would be expected to increase the methylation and the biohazard of Hg. (Peters-PTT)
W87-02584

LEVELS OF CHLORINATED HYDROCARBONS AND COMPOSITION OF PCB IN HERRING GULL LARUS ARGENTATUS EGGS COLLECTED IN NORWAY IN 1969 COMPARED TO 1979-81,
National Veterinary Inst., Oslo (Norway).
M. T, Moksnes, and G. Norheim.
Environmental Pollution (Series B) EPSPDH, Vol. 11, No. 1, p 109-116, 1986. 1 fig, 2 tab, 12 ref.

Descriptors: *Gulls, *Chlorinated hydrocarbons, *Eggs, *Norway, Hexachlorobenzene, Octachlorostyrene, Decachlorobiphenyl, Pesticides, Chemical degradation.

The levels of hexachlorobenzene (HCB), octachlorostyrene (OCS), decachlorobiphenyl (DCB), DDE and PCB in eggs from herring gull Larus argentatus collected from different parts of Norway during 1979-81 were determined and compared with levels in eggs collected in 1969. A total of 112 herring gull eggs were collected at seven different places. In addition, 88 eggs previously collected at the same places in 1969 were analyzed at the same time. The localities include: Ostfold (Heia, Hvalar, Akeroy); Telemark (Jomfruland, Straholmen); Rogaland (Karmoy); Hordaland (Bergen); Sor-Trondelag (Tarva); Nordland (Sandnessjoen); and Finnmark (Reinoy, Vardo). Mean levels of HCB in 1969 and 1979-81 were 0.19 and 0.12 microgram/g wet weight, respectively. When excluding the results from Telemark, an area with local contamination by HCB, OCS and DCB, there were no statistical differences in HCB levels between the two sampling periods. OCS and DCB were only detected in eggs from Telemark. Significant decreases in DDE levels and DDE/PCB ratios but not in PCB levels were observed between 1969 and 1979-81. Only for the most persistent of the PCB isomers recorded was there a small increase in the relative amount from 1969 to 1979-81. (Peters-PTT)
W87-02585

DETERMINATION OF POLLUTION AND EUTROPHIC CONDITIONS OF SAPANCA LAKE (TURKEY),
Marmara Scientific and Industrial Research Inst., Gebze (Turkey). Dept. of Nutrition and Food Technology.
V. Yigit, N. Muftugil, and H. Kalafatoglu.
Toxicological and Environmental Chemistry TXECBP, Vol. 11, No. 1, p 1-7, 1986. 2 fig, 1 tab, 7 ref.

Descriptors: *Lakes, *Water sampling, *Water quality, *Chemical properties, *Sapanca Lake, *Eutrophication, Temperature, Hydrogenion concentration, Dissolved oxygen, Phosphates, Nitrogen, Mercury, Coliform, Turkey, Chlorophyll-a, Nutrients.

Temperature, pH, dissolved oxygen and phosphates, chlorophyll-a, oil and grease, nitrogen, mercury and total coliform contents of water samples from Sapanca Lake have been determined. Sapanca Lake is located between the sea of Marmara (Izmit Bay) and Sakarya River. Small brooks flow into the lake which also has some underground natural waters. It is discharged by Cark Canal to the Sakarya River, thus constituting a continuous flow system. The lake is used as follows: resource for water; recreation and resort area, catching fish and other water products; agricultural irrigation; transportation; and receptacle for domestic wastes. The results indicate that industrial contamination is not significant in the lake at present and the nutrient concentrations are low. (Peters-PTT)
W87-02587

ENVIRONMENTAL FACTORS AFFECTING THE ACID NEUTRALIZATION CAPACITY OF FINNISH GLACIAL TILL DEPOSITS,
Helsinki Univ. (Finland). Dept. of Geology.
A. Vuorinen, and P. Lahermo.
Toxicological and Environmental Chemistry TXECBP, Vol. 11, No. 1, p 61-78, 1986. 12 fig, 12 ref.

Descriptors: *Acid rain, *Glacial drift, *Leaching, *Finland, *Iron, Aluminum, Potassium, Calcium, Zinc, Sediments, Soils, Humic substances, Geochemistry, Till profile, Acid neutralization, Buffer capacity, Iron specification, Bedrock.

A batch titration method for acid neutralization buffer capacity was used to monitor the stage of leaching and resistance to acid precipitation of surfical deposits in Finland. Four till profiles, including podzol horizons, were sampled at different geographical, climatoglogical and environmental sites in Finland. The fresh samples were air dried, homogenized and then equilibrated at increasing acidity in capped polyethylene tubes. After centrifugation and measurement of the pH in the tubes, the contents of leached elements were analyzed using colorimetric methods for Fe, Al, and Si, and flame-AAS methods for K, Ca, Fe, Mn, and Zn. A sequential extraction procedure at different time intervals was used for Fe oxides. The acid neutralization buffer capacity was strongly affected by the environmental geochemistry of iron. The leaching of Fe from bedrock and sedi-

ments accompanied by seasonal and biogeochemical cycles, and reprecipitation of Fe is widespread in Finnish soils. As a consequence, the loosely bound Fe forms seem to constitute the main acid neutralization buffer capacity found in sediments. Exchangeable Al and also alkali and alkaline earth metals (especially Ca) may occasionally be of importance in contributing to the acid neutralization capacity of sediments. Humic substances play a major role in topsoil layers. A slight effect of acid precipitation is inferred in the topsoil of the two most southern profiles. (Author's abstract)
W87-02588

RATIONAL ALLOCATION OF MONITORING STATIONS IN A LAKE BY MEANS OF THE SPLINE TECHNIQUE,
Kyoto Univ. (Japan). Dept. of Environmental and Sanitary Engineering.
For primary bibliographic entry see Field 7A.
W87-02598

VALIDATION OF A PROGNOSIS BASED UPON A EUTROPHICATION MODEL,
Royal Danish School of Pharmacy, Copenhagen.
For primary bibliographic entry see Field 5C.
W87-02602

MODELING FOR ESTIMATING REPRESENTATIVE WATER CONDITIONS IN A RIVER BASIN,
Tokyo Univ. (Japan). Dept. of Urban Engineering.
A. Ichikawa, and K. Amano.
Ecological Modelling, Vol. 32, No. 1-3, p 199-213, June 1986. 5 fig, 7 tab.

Descriptors: *Rivers, *Path of pollutants, *Model studies, *Pollution load, *Dry season, *Tama River, Japan, Mathematical models.

A modeling method is proposed that includes two parts for estimating representative river-water conditions, one for spatial representation of the generated pollution loadings and another for temporal representation of flowing pollution loading in a waterway. The model was employed to estimate pollution loadings during a dry period at the branches or drains in the middle basin of the Tama River. The results were compared with those of a large-scale river survey conducted in August 1981. Based on the ratio of estimated values to observed conditions, the methodology for quantification of pollution loadings is judged to be reasonable. (Rochester-PTT)
W87-02604

LEAD DISSOLUTION FROM SOLDERED JOINTS,
Avon Dept. of Health, CT.
H. H. Birden, E. J. Calabrese, and A. Stoddard.
Journal of the American Water Works Association JAWWA5, Vol. 77, No. 11, p 66-70, November 1985. 3 fig, 5 tab, 12 ref.

Descriptors: *Lead, *Water pollution sources, *Plumbing, *Solder, *Drinking water, Connecticut, Copper piping, Groundwater pollution, Copper, Heavy metals.

Levels of lead in tap water exceeding the US Environmental Protection Agency primary drinking water standard of 0.05 mg/L have been reported in several Connecticut communities. Investigations revealed that the lead originates from the leaching of soldered joints in recently constructed plumbing systems, not from source water supplies. A study examined the phenomenon quantitatively with plumbing runs fabricated from the most commonly used plumbing materials and solder formulations. Tests of two groundwater sources of different corrosivity run through soldered copper piping demonstrated levels of lead well in excess of the US EPA standard. Lead levels declined with time and varied with the type of solder used and the corrosivity of the water. Elimination of lead in solders and education of the public are suggested as countermeasures. (Author's abstract)
W87-02607

FUNGI IN POTABLE WATER DISTRIBUTION SYSTEMS,
Drexel Univ., Philadelphia, PA. Dept. of Biological Sciences.
W. D. Rosenzweig, H. Minnigh, and W. O. Pipes.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 1, p 53-55, January 1986. 2 tab, 20 ref.

Descriptors: *Fungi, *Potable water, *Water distribution systems, *Potable water, *Water quality, Pathogenic bacteria, Viruses, Protozoa, Alternaria, Aspergillus, Cladosporium, Penicillium, Microorganisms, Feces, Statistical analysis.

In the past, the microbiological quality of potable water has been based on the occurrence of coliform bacteria. The presence of organisms indicates the possibility of fecal contamination with a resulting presence of pathogenic bacteria, viruses, and protozoa. Of 207 samples collected from various locations in five small municipal water distribution systems, 103 (49.8 %) were positive for fungi. Counts ranged between 1 and 6 fungal propagules per 50-mL sample. Four genera, Alternaria, Aspergillus, Cladosporium, and Penicillium, accounted for 58 percent of the isolates, with Aspergillus the most common (18.4 %). Statistical analysis of the data to determine any relationship between the presence and number of fungal isolates and five physicochemical and two bacteriological parameters revealed no significant correlations. (David-PTT)
W87-02614

GENERALIZATION AND APPLICATIONS OF TRACER DISPERSION DATA,
Geological Survey, Reston, VA. Water Resources Div.
F. A. Kilpatrick, and K. R. Taylor.
Water Resources Bulletin WARBAQ, Vol. 22, No. 4, p 537-548, August 1986. 16 fig, 21 ref.

Descriptors: *Tracers, *Data interpretation, *Dispersion studies, *Solute transport, Waterways, Contamination, Prediction, Solubility, Simulation analysis, Injection.

An approach to unitizing data generated by numerous time-of-travel and tracer dispersion studies to make it more useful for predicting the behavior of soluble contaminants entering waterways is presented. Practical application of the superimposition principle and of the scalene triangle as an approximation of the response curve from slug injection of a solute are demonstrated as a means of simulating downstream effects of any form of solute release. (Michael-PTT)
W87-02620

ALTERNATIVES TO THE USE OF AGRICULTURAL DRAINAGE WELLS,
Iowa State Univ., Ames. Dept. of Agricultural Economics.
For primary bibliographic entry see Field 4B.
W87-02624

ANOMALOUS NATURAL SULFATE IN WATER WELLS OF THE GREENBRIER GROUP, WEST VIRGINIA,
Charleston Coll., SC.
S. A. Heller, and H. W. Rauch.
Water Resources Bulletin WARBAQ, Vol. 22, No. 4, p 581-585, August 1986. 5 fig, 1 tab, 7 ref.

Descriptors: *Sulfates, *Wells, *West Virginia, Well data, Groundwater, Calcium, Magnesium, Chlorides, Sodium, Dolomite, Gypsum, Ions, Oxidation, Halite, Pyrite, Thermal springs, Geologic fractures.

Water from wells developed in the Middle Mississippian Greenbrier Group of central West Virginia is typically very hard. Eight of 74 wells sampled showed high sulfate concentrations and higher than average concentrations of calcium, magnesium, chloride and sodium. Water from several of these wells was not potable. Previous work has suggested that dolomite and gypsum dissolution contribute magnesium and sulfate ions to the groundwater. Halite dissolution and pyrite oxidation are likely contributors to concentrations of sodium, chloride and iron above background. All of these minerals are generally associated with the basal water-bearing strata of the Greenbrier Group. It is possible that the wells are receiving deeply circulating groundwater via fracture zones which feed other sulfur and/or thermal springs in the central Appalachia. (Author's abstract)
W87-02625

UNSATURATED FLOW THROUGH SOLID WASTE LANDFILLS: MODEL AND SENSITIVITY ANALYSIS,
Rutgers - The State Univ., Piscataway, NJ. Dept. of Civil and Environmental Engineering.
A. C. Demetracopoulos, G. P. Korfiatis, E. L. Bourodimos, and E. G. Nawy.
Water Resources Bulletin WARBAQ, Vol. 22, No. 4, p 601-609, August 1986. 10 fig, 31 ref.

Descriptors: *Path of pollutants, *Unsaturated flow, *Water pollution sources, *Mathematical models, *Landfills, *Sensitivity analysis, Mathematical equations, Boundary conditions, Parametric hydrology, Porosity, Simulation analysis, Design criteria, Solid waste disposal.

The governing equations, boundary conditions and method of solution of the flow of precipitation through solid waste landfills are presented. A detailed sensitivity analysis is performed to investigate the effects of various parameters associated with the hydraulics of porous material, input conditions and numerical techniques on the model results. This analysis is performed by simulations of a conceptual landfill and the results provide guidelines for model application to the design of new solid waste facilities and evaluation of existing landfills. (Michael-PTT)
W87-02628

RED ALDER LEAF LITTER AND STREAM-WATER QUALITY IN WESTERN OREGON,
Oregon State Univ., Corvallis. Dept. of Forest Engineering.
R. L. Taylor, and P. W. Adams.
Water Resources Bulletin WATBAQ, Vol. 22, No. 4, p 629-635, August 1986. 8 fig, 2 tab, 24 ref.

Descriptors: *Deciduous trees, *Water pollution sources, *Alder trees, *Leaves, *Impaired water quality, *Oregon, Color, Decomposing organic matter, Leaching, Organic carbon.

Studies of an Oregon municipal watershed demonstrated the potential water quality effects of streamside red alder leaves, but sampling during 1981-1982 showed no chronic problems. Some short-term increases in water color were observed near the onset of storm flows which suggested a flushing of organic matter storage sites. An extended period of unusually low flows and high leaf fall may be necessary to impact water quality in this area. Laboratory leaching of alder leaves in filtered stream water showed a fairly constant release of colored organic matter over time with running water leaching more efficiently than still water. Water color increased linearly with increasing leaf mass added to still water. There appeared to be a limit to the amount of colored matter that could be removed during the first 48 hours of leaching. Other tests showed that ultraviolet absorbance could provide an estimate of dissolved organic carbon concentration in systems dominated by alder leaf inputs. (Author's abstract)
W87-02631

CONTAINING LANDFILL LEAKS,
Camp, Dresser and McKee, Inc., Boston, MA.
C. Beatty.
The American City and County ACCOD3, Vol. 101, No. 4, p 28, 30, 32, April 1986.

Descriptors: *Landfills, *Water pollution sources, *Water pollution control, *Design criteria, Cost analysis, Political aspects, Groundwater runoff.

Design alternatives and other measures to control landfill runoff are reviewed. Landfill improvement costs and political issues impacting landfill development programs are also examined. There is a national consensus that tighter environmental controls are needed. (Michael-PTT)
W87-02639

DETECTION OF ROTAVIRUS IN TREATED DRINKING WATER,
Texas Univ. Medical School at Houston.
B. H. Keswick, C. P. Gerba, J. B. Rose, and G. A. Toranzos.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 1-6, October 1985. 5 tab, 12 ref. EPA Cooperative agreement CR-809331-02-0.

Descriptors: *Rotavirus, *Drinking water, *Water treatment, *Water quality management, *Water quality standards, *Pollutant identification, Enteroviruses, Viruses, Potable water, Chlorination, Water pollution, Coliforms, Bacteria, Streptococcus, Pathogenic bacteria, Public health, Human diseases, Diseases.

Rotavirus was recovered from 16 of 63 conventionally treated finished drinking water samples collected at a full-scale drinking water treatment plant. Rotavirus recovery was higher during the summer rainy season, when the water quality dramatically declined. Twenty-six of 54 samples of finished water collected during the dry season met acceptable limits for turbidity, total coliform bacteria and residual chlorine; three of these samples contained rotavirus, indicating that water from polluted sources which meets water quality guidelines cannot be assumed to be virus-free. This raises questions concerning the ability of currently suggested limits to ensure safe drinking water; fecal streptococci may be better indicators of the sanitary quality of water than the total coliform bacteria. Increased chlorine contact time reduced the bacterial content of water, but did not necessarily reduce the rotavirus content. Further studies are needed on the factors which affect the removal of important disease-causing waterborne viruses such as rotavirus, Norwalk virus, and hepatitis A virus. (Doria-PTT)
W87-02643

VIRUSES AND BACTERIA IN A CHALK WELL,
Thames Water Authority, London (England).
J. S. Slade.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 111-125, October 1985. 1 fig, 6 tab, 10 ref.

Descriptors: *Viruses, *Bacteria, *Chalk, *Water pollution sources, *Water wells, *Groundwater pollution, *Monitoring, *Drinking water, Water analysis, Disinfection, Chlorination, Enteroviruses, Indicators, Wells, Bioindicators, Groundwater, Subsurface water, Potable water.

Human enteroviruses have been found in water from a chalk well with a history of excellent bacteriological and organoleptic quality. A proportion of these viruses survived disinfection treatment consisting of a nominal 1 mg/l of free chlorine maintained for a minimum contact period of 15 minutes at pH 7.2. It is concluded that viruses may occur in underground sources which have consistently proved to be satisfactory in routine monitoring tests for bacterial indicators of fecal pollution. Possible mechanisms by which these circumstances may arise are discussed. It is concluded that bacteria and viruses can become separated during the passage of water through underground strata, and this throws serious doubts upon the present practice of relying solely on the absence of bacterial indicators as the measure of safety of underground sources. (Doria-PTT)
W87-02655

INTERACTIONS BETWEEN BIOTIC AND ABIOTIC FACTORS AND VIRUSES IN A WATER SYSTEM,
Medizinische Akademie 'Carl Gustav Carus' Dresden (German D.R.). Inst. fuer Allgemeine und Kommunale Hygiene.
R. Walter, J. Durkop, B. Friedman, and H. J. Dobberkau.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 139-151, October 1985. 5 fig, 3 tab, 10 ref.

Descriptors: *Viruses, *Rivers, *Pollutant identification, *Water analysis, *Water pollution sources, *Chemical properties, *Water pollution, Enteroviruses, Water quality management, Nitrates, Ammonium compounds, Heavy metals, Nitrogen compounds, Wastewater, Potable water, Microbiological studies, Statistical analysis, Effluents, Protozoa.

A river used intensively both for potable water and for effluent discharge carries a high load of viruses, including hepatitis A and rotaviruses. Hepatitis A is endemic in areas supplied with potable water from this river. The river has been investigated from 1981 to 1983 for its virological, biological, microbiological, and chemical properties. In addition, tests for heavy metals and for selected chemical compounds were performed at some representatively distributed sampling points along the river. The virological quality of the river largely depends on the virus input via domestic sewage. Significant correlations have been found between virus level, pH, ammonium ion, and nitrate. Chemical pollution will be virus protective if particulate matter and some kinds of cations are discharged, pH is altered, and biotic antagonisms are suppressed. Chemical pollution will also exhibit some virucidal capacities caused by the actions of some ionic detergents, heavy metals, phenol, and chaotropic agents. Amoebae may counteract viruses. A model for the estimation of virus content in the raw water could be developed knowing the dynamics of river water exploitation above the extraction sites. (Doria-PTT)
W87-02657

DETECTION OF INDIGENOUS ENTERIC VIRUSES IN RAW SEWAGE EFFLUENTS OF THE CITY OF ATHENS, GREECE, DURING A TWO YEAR SURVEY,
Institut Pasteur Hellenique, Athens (Greece). Dept. of Virology.
V. Krikelis, P. Markoulatos, N. Spyrou, and Ch. Serie.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 159-164, October 1985. 3 tab, 23 ref. Ministry of Research and Technology Project 81082.

Descriptors: *Enteroviruses, *Wastewater, *Effluents, *Municipal wastewater, *Athens, *Pollutant identification, *Surveys, Viruses, Microbiological studies, Water pollution, Seasonal variation, Coxsackie virus, Public health, Human diseases, Diseases.

Indigenous Enteroviruses and Adenoviruses have been detected in a two-year survey of urban sewage effluents in Athens, Greece during 1982-1983. Polio, Coxsackie B, and Echoviruses were recovered on Vero or BGM cells by inoculation of samples after a pre-concentration step utilizing glass powder. Adenoviruses were recovered on Hep2 cells after precipitation with protamine sulfate. The viral content was in the order of 100-1,000 cytopathogenic units (CPU) per liter of sample. Seasonal fluctuations of serotypes were observed. The peak of Adenoviruses was found in early spring, whereas Enteroviruses peaked in late summer-early fall. The most frequently recovered serotypes within each group were: Polio III (47%), Coxsackie B5 (56%), Echo 7 (61%), and Adeno 7 (43%). Similar isolation frequencies, except for Polio, were found in humans as well. All strains of Polioviruses recovered from sewage were found to be vaccine-related by the intratypic serodifferentiation test. (Doria-PTT)
W87-02659

DETECTION AND STABILITY OF ENTERIC VIRUSES IN SLUDGE, SOIL AND GROUND WATER,
Kongelige Veterinaer- og Landbohoejskole, Copenhagen (Denmark). Dept. of Veterinary Virology and Immunology.
P. H. Jorgensen, and E. Lund.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 185-195, October 1985. 6 fig, 14 ref.

Descriptors: *Pollutant identification, *Enteroviruses, *Sludge, *Soil types, *Groundwater, Viruses, Municipal wastewater, Coxsackievirus, Sediments, Survival.

Digested sludge from a municipal sewage treatment plant was placed on the surface of pure diluvial sand in a forest plantation. Polio-, coxsackie-, and adenovirus types were detected in the sludge deposits up to 21 weeks, but not 22 weeks, after application. No virus was demonstrated in soil samples five weeks after application. Groundwater samples were negative, except for one sample containing poliovirus type 2 and coxsackievirus type B3. Soil samples collected at a depth of 35 to 100 cm were suspended in groundwater from the area and antibiotics were added; pH was 4.5. A similar system was set up using a sand loam soil. In each series, three flasks were seeded with coxsackievirus B3, adenovirus 1, and echovirus 7, respectively. Supernatants and eluates of the sediments were examined for virus. Adenovirus was not found in the supernatants. Echovirus occurred only in the supernatant from sandy soil, and coxsackievirus occurred in both supernatants. Except for adenovirus in sandy loam soil, the viruses were quite stable in the sediments. Results from groundwater samples were similar, except that echovirus could not be demonstrated in groundwater from the sandy soil area after two months. (Author's abstract)
W87-02662

EXAMINATION OF THE PENETRATION OF ENTERIC VIRUSES IN SOILS UNDER SIMULATED CONDITIONS IN THE LABORATORY,
Kongelige Veterinaer- og Landbohoejskole, Copenhagen (Denmark). Dept. of Veterinary Virology and Immunology.
P. H. Jorgensen.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 197-199, October 1985. 5 ref.

Descriptors: *Enteroviruses, *Path of pollutants, *Water pollution sources, *Soil science, *Soil columns, *Aeration zone, *Saturated soil, *Solute transport, Viruses, Soil types, Coxsackievirus, Sand, Loam, Rain.

Transport of coxsackievirus B3 and adenovirus 1 could not be demonstrated below 3.5 cm under the soil surface in two different unsaturated soil columns percolated with artificial rainwater under simulated aerated conditions. The viruses were applied to the columns as seeded sewage sludge. Under saturated conditions, transport of water-suspended coxsackievirus B3 was faster in a soil column with sandy loam soil than in a diluvial sand column. Both types of viruses could be recovered from the top layer of both columns at the end of the experiment. Coxsackievirus was more stable than adenovirus both in sludge controls and in artificial rainwater kept under the same conditions as the columns. Results indicate that both types of virus are strongly solid-associated in the sludge and in the soils. If virus concentrations are plotted against the number of percolated theoretical pore volumes, the curve indicates that the transport mechanisms for virus in sandy loam soil are convective transport combined with adsorption, inactivation, and dispersion. However, differences between the two soil types may reflect differences in the distribution of the pore sizes of the soils. (Doria-PTT)
W87-02663

MIXING COEFFICIENT FOR ICE-COVERED AND FREE-SURFACE FLOWS,
National Water Research Inst., Burlington (Ontario). Hyrdraulics Research Div.
For primary bibliographic entry see Field 2E.
W87-02671

CHARACTERIZATION OF WATER USING COMBINED SEWER OVERFLOWS, (CARACTERIZATION DES EAUX USEES DE DEBORDEMENTS DE RESEAU UNITAIRE),
P. Lessard, and P. Lavalle.
Canadian Journal of Civil Engineering CJCEB, Vol. 12, No. 3, p 527-537, September 1985. 5 fig, 3 tab, 20 ref.

Descriptors: *Sewer overflow, *St. Charles River, *Catchment areas, *Rain events, *Water quality, Runoff, Pollutant loads, Urban runoff, Quebec.

In 1981, the City of Quebec signed a protocol with the Quebec Ministry of Enviroment permitting the study of the impact of combined sewer overflows (CSO) during rain periods on the St.-Charles River. One of the main study objectives was to characterize CSO, both quantitatively and qualitatively. Five main drainage basins, representative of the study area, were selected and sampled during nine rain events. Certain appraisals were made to explain the importance of the water quality variations during rain events in combined sewers, dry weather period influence on runoff quality, and 'first-flush' phenomenon. Two principal conclusions have been drawn from these data: (1) the major part of the pollutant load routed through a combined sewer network during a rain event is generated by surface runoff and dragging of sewage deposits, and (2) the overall water quality of CSO doesn't seem to vary much from one basin to another, even if the percentages associated with different types of land use (residential, commercial, industrial, etc.) are different. (Author's abstract)
W87-02672

HIGH CONCENTRATION OF SOLUTES AT THE UPPER PART OF THE SATURATED ZONE (WATER TABLE) OF A DEEP AQUIFER UNDER SEWAGE-IRRIGATED LAND,
Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.
For primary bibliographic entry see Field 2F.
W87-02677

WAVE MOVEMENT AND WATER-QUALITY VARIATIONS DURING A CONTROLLED RELEASE FROM KIELDER RESERVOIR, NORTH TYNE RIVER, U. K.,
Loughborough Univ. of Technology (England). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W87-02681

MODELLING THE EFFECTS OF HYDROLOGICAL CHANGES ON STREAM WATER ACIDITY,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W87-02684

MICROBIAL POLYMERS IN THE AQUATIC ENVIRONMENT-III: ISOLATION FROM RIVER, POTABLE AND UNDERGROUND WATER AND ANALYSIS,
Guelph Univ. (Ontario). Dept. of Zoology.
J. Chudoba, J. Hejzlar, and M. Dolezal.
Water Research WATRAG, Vol. 20, No. 10, p 1223-1227, October 1986. 3 fig, 8 tab, 7 ref.

Descriptors: *Aquatic environment, *Groundwater, *Polymers, *Microorganisms, *Rivers, *Potable water, *Water analysis, Chemical oxygen demand, Hydrolysis, Sugars, Amino sugars, Amino acids, Czechoslovakia, Waste products.

Organic substances from three rivers in Czechoslovakia, one tap and one underground water were concentrated by vacuum distillation and the polymers with molecular weight (MW) >10000 were isolated by dialysis and lyophilization. The chemical oxygen demand (COD) of the lyophilizates amounted to 19.8, 28.9, and 23.9% of the total COD in river waters, and to 13.9 and 13.1% of the total COD in tap and underground waters, respectively All isolated polymers contained sugars, amino sugars, and amino acids, which indicate their microbial origin. The sum of these compounds amounted to 5.6, 6.8 and 9.0% of all organic substances present in river waters and 1.9 and 0.8% of those present in tap and underground water, respectively. It is concluded that the microbial polymers are ubiquitous and form part of the organic background of the aquatic environment. (See also W87-02694 - W87-02695) (Author's abstract)
W87-02696

ION EXCHANGE PROPERTIES OF RETORTED RUNDLE OIL SHALE,
Queensland Univ., Brisbane (Australia). Dept. of Chemical Engineering.
A. A. Krol, P. R. F. Bell, P. F. Greenfield, and M. J. Dunstan.
Water Research WATRAG, Vol. 20, No. 10, p 1299-1306, October 1986. 8 fig, 4 tab, 23 ref.

Descriptors: *Oil shale, *Path of pollutants, *Ion exchange capacity, *Model studies, *Leachate, Selectivity coefficient, Australia, Mining, Surface runoff, Evaporative flux, Prediction, Aquifers, Health hazards, Hydrogen ion concentration, Ions.

Rundle spent shale represents a mixture of materials which show different inorganic ion-exchange characteristics. Some exchange sites are of the constant charge type while others are of the constant potential type, showing some variation of charge with pH. In the 7-8 pH range, however, the value of the cation exchange capacity (CEC) can be taken to be approx. constant at 21 m-equiv/100 g. After one month's weathering of the shale in a leaching column, this value increased to 23-25.5 m-equiv/100 g. Spent shale exhibits negligible anion exchange capacity (AEC). Competitive exchange of cations can be described by the use of selectivity coefficients. Highly specific exchange for the monovalent cations results in their exchange coefficients showing a dependence on their concentration. This dependence was not well characterized with only average values being determined for flow modelling purposes. Cation exchange plays a major role in controlling the appearance of cations in leachate eluted from a column of spent Rundle oil shale. (Alexander-PTT)
W87-02707

DIEL VARIATION OF IN-STREAM NITRIFICATION,
Texas Univ. at Dallas, Richardson. Graduate Program in Environmental Sciences.
J. J. Warwick.
Water Research WATRAG, Vol. 20, No. 10, p 1325-1332, October 1986. 8 fig, 2 tab, 11 ref.

Descriptors: *Diel variation, *Nitrification, *Path of pollutants, *Fate of pollutants, *Model studies, *SNOAP models, *Water quality models, Nonlinear regression analysis, Hydrogen ion concentration, Dissolved oxygen, Temperature, Photosynthesis, Kinetics.

The diel variation of in-stream nitrification is explained as a function of observed fluctuations in temperature and pH. A simultaneous nitrogen and dissolved oxygen mass balance model (SNOAP model) was used to calculate hourly nitrification rate coefficient values. These calculated rate coefficients were based upon observed spatial and temporal changes in nitrogen species and dissolved oxygen concentrations. A non-linear regression analysis was performed to determine the functional relationship between calculated in-stream nitrification and observed changes in bulk fluid temperature and pH. Nitrification rates have traditionallly been reported at 20 C. The results have reinforced the significant impact of pH on in-stream nitrification. It is therefore important to consider both temperature and pH when calculating a baseline nitrification rate. (Alexander-PTT)
W87-02711

INFLUENCE OF SOIL STRUCTURE ON MOVEMENT RATE OF SALTS THROUGH SOILS,
Oklahoma Agricultural Experiment Station, Stillwater.
T. A. Tindall, L. G. Morrill, and L. J. Henderson.
Soil Science SOSCAK, Vol. 142, No. 2, p 108-113, August 1986. 4 fig, 2 tab, 12 ref.

Descriptors: *Soil structure, *Path of pollutants, *Solutes, *Solute transport, *Salts, Rubidium, Cations, Groundwater movement, Clay loam, Soil columns, Soil classification.

The effect of soil structure on the movement rate of cations was studied by determining the relative mobility of rubidium in four similar soils of different structural types by replicated, undisturbed and constructed soil columns. The soils had similar mineralogical composition and were classed as sandy clay loams. Structural types included: (1) weak, coarse prismatic; (2) moderate, angular blocky; (3) moderate, medium subangular blocky; and, (4) moderate, medium granular. Rubidium concentrations were determined in solutions withdrawn via ceramic cups at different depths and times and in sectioned column extracts. Rubidium moved 1.4 to 1.6 times deeper in soils with coarse structural units. There were no significant differences between soils with medium-sized structural units and the constructed soil columns. (Michael-PTT)
W87-02716

ATMOSPHERIC METHANE SOURCES: ALASKAN TUNDRA BOGS, AN ALPINE FEN, AND A SUBARCTIC BOREAL MARSH,
National Aeronautics and Space Administration, Hampton, VA. Langley Research Center.
D. I. Sebacher, R. C. Harriss, K. B. Bartlett, S. M. Sebacher, and S. S. Grice.
Tellus TELLAL, Vol. 38B, No. 1, p 1-10, February 1986. 3 fig, 4 tab, 39 ref, append.

Descriptors: *Methane, *Tundra, *Fens, *Bogs, *Marshes, *Arctic zone, *Air pollution, *Alaska, Fluctuations, Field tests, Peat, Permafrost, Wetlands.

Methane flux was measured in tundra bogs, an alpine fen and a subarctic boreal marsh in Alaska. Significant methane emissions were detected in tundra areas where peat temperatures were as low as 4 C and permafrost was only 25 centimeters below the surface. Emission rates were logarithmically related to water levels at the 17 sites sampled. Extrapolation of data for estimating total annual methane emissions from all arctic and boreal wetlands suggests that these ecosystems are a major source of atmospheric methane and could account for up to 23% of global methane emissions from wetlands. (Author's abstract)
W87-02719

DEPOSITION OF ATMOSPHERIC TRACE METALS IN NORTHERN SWEDEN AS MEASURED IN THE SNOWPACK,
Stockholm Univ. (Sweden). Meteorologiska Institutionen.
H. B. Ross, and L. Granat.
Tellus TELLAL, Vol. 38B, No. 1, p 27-43, February 1986. 6 fig, 9 tab, 31 ref. Natural Science Research Council (Sweden) Contract G-GU 3922-111.

Descriptors: *Path of pollutants, *Water pollution sources, *Deposition, *Trace metals, *Snowpack, *Sweden, Ions, Cadmium, Lead, Zinc, Sulfates, Atmospheric transport.

Snowpack in northern Sweden was sampled and analyzed for trace metals and major ions. Comparison of major ion concentrations in the snowpack and monthly precipitation indicated that few of the major ions escaped from the snowpack. This is presumably also true for trace metals. Metal concentrations in the region decreased from the Baltic coast toward the interior of Sweden and the lowest concentrations were found in the Swedish mountains near the Norwegian border. Concentrations in this area were comparable to those found in snow in Greendland and in the European Arctic near Spitsbergen. The concentration of Cd, Pb, Zn and sulfate were highly correlated to one another. It is concluded that trace metal deposition in

northern Sweden during the winter is due mainly to long-range transport. (Author's abstract)
W87-02720

COMPOSITION OF PRECIPITATION WATER AND ITS ACIDITY,
Akademie der Wissenschaften der DDR, Berlin. Inst. fuer Geographie und Geooekologie.
D. Moller, and R. Zierath.
Tellus TELLAL, Vol. 38B, No. 1, p 44-50, February 1986. 2 tab, 36 ref.

Descriptors: *Chemistry of precipitation, *Acidity, *Acid rain, Rain, Hydrogen ion concentration, Anions, Cations, Iron, Aluminum, Particulate matter, Neutralization, Europe, Regional analysis, Nitrates, Bases, Mathematical equations.

pH was calculated from the mean ionic composition of precipitation water as published in the literature. Calculated pH is compared to measured mean pH based on precipitation-weighted hydrogen ion concentrations and deviations are related to gaps in the anion-cation balance. Particulate contribution to the atmosphere bicarbonate in rainwater plays an important role in areas with highly basic soil. Basic contributors such as iron and aluminum oxides are an important influence on pH in areas where lignite-fired powerplants are located. Some regional particularities in neutralizing capacity have also been found. The percentage of basic species in European precipitation is twice as high as in North America, but there are no differences between eastern and western Europe. The nitrate share in eastern European rainwater is one-third less than that in western Europe. (Author's abstract)
W87-02721

PERCOLATION OF WATER BELOW AN IRRIGATED FIELD,
Agricultural Research Service, Phoenix, AZ. Water Conservation Lab.
R. C. Rice, R. S. Bowman, and D. B. Jaynes.
Soil Science Society of America Journal SSSDJ4, Vol. 50, No. 4, p 855-859, July-August 1986. 9 fig, 3 tab, 16 ref.

Descriptors: *Deep percolation, *Irrigation, *Path of pollutants, Bromides, Tracers, Hydrologic budget, Solutes, Pollutants, Groundwater pollution, Mathematical equations.

Deep percolation of excess irrigation water was measured in a bare soil field. Deep percolation rates were determined by adding a bromide tracer to the soil and taking core samples after each irrigation. Maximum bromide concentration depth was uniformly distributed over the field. Average deep percolation rate was determined from the arithmetic mean of the tracer velocities and water content. The deep percolation rate calculated from the tracer velocities was about five times greater than that determined from a water balance. This discrepancy between tracer and water balance rates indicates that much of the water is moving in preferential paths and that water balance may overestimate travel times of solutes and pollutants in groundwater. (Michael-PTT)
W87-02722

IMMISCIBLE CONTAMINANT TRANSPORT IN SOILS AND GROUNDWATER WITH AN EMPHASIS ON PETROLEUM HYDROCARBONS: SYSTEM OF DIFFERENTIAL EQUATIONS VS SINGLE CELL MODEL,
Delaware Univ., Newark. Dept. of Civil Engineering.
M. Y. Corapcioglu, and A. Baehr.
Water Science and Technology WSTED4, Vol. 17, No. 9, p 23-37, September 1985. 12 fig, 2 tab, 17 ref. NSF Grant CEE-8401438; ASC Petroleum Research Fund PRF 15890-AC5; DOI Grant G-897/02.

Descriptors: *Path of pollutants, *Mathematical models, *Immiscibility, *Pollutants, *Fate of pollutants, *Soil properties, *Groundwater, *Hydrocarbons, *Model studies, *Differential equations, Prediction, Estimation, Mathematical studies, Gasoline, Fuel, Solutes, Solute transport.

A generalized mathematical model is presented which incorporates the physical, chemical, and biological processes that collectively describe the transport of a reactive and immiscible contaminant in soils and groundwater. The problem is one of multiphase transport: the contaminant can be transported as solutes in water, vapors in air, and as unreacted constituents in an immiscible phase. It also may be adsorbed onto the soil surface. Conservation principles lead to a system of nonlinear partial differential equations governing the phenomenon. In addition, a single cell model is presented as a simplified version of this system. The whole system is represented by a single element, yielding conservative estimates of a single constituent contaminant, as only advective solute transport is allowed. The model has been applied to the fate and transport of individual hydrocarbons in an unsaturated zone. Results predict the concentrations of each hydrocarbon in all phases in space and time, allowing the user to estimate the amounts of hydrocarbons which enter the underlying aquifer or which leave the soil via volatilization into the atmosphere. Such predictions are presented for selected cases, and comparisons of the single cell model with the generalized one are given. (Author's abstract)
W87-02729

SORPTION OF HYDROPHOBIC TRACE ORGANIC COMPOUNDS IN GROUNDWATER SYSTEMS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
R. P. Schwarzenbach, and J. Westall.
Water Science and Technology WSTED4, Vol. 17, No. 9, p 39-55, September 1985. 8 fig, 1 tab, 22 ref.

Descriptors: *Sorption, *Path of pollutants, *Organic compounds, *Groundwater pollution, *Fate of pollutants, Trace levels, Partition coefficients, Water pollution, Groundwater, Chemical properties, Physicochemical properties, Aquifers, Organic carbon, Carbon, Mathematical studies.

Factors influencing the subsurface sorption behavior of neutral and ionizable trace organic compounds are discussed. At equilibrium, the sorption of a neutral hydrophobic organic compound can be expressed by a simple partition coefficient. Partition coefficients, and thus retardation factors, may be estimated from the octanol/water partition coefficient of the compound and the organic carbon content of the aquifer material, if the organic carbon content exceeds 0.1%. For ionizable (anionic) hydrophobic compounds (represented by chlorinated phenols), the distribution ratio depends on both the pH and ionic strength of the aqueous phase, in contrast to the partitioning model for neutral compounds in which the composition of the aqueous phase is relatively unimportant. The existence of free inorganic ions in octanol must be taken into account in experiments involving distribution of ionic compounds between water and natural organic carbon. It is also expected that amphiphilic molecules such as pentachlorophenolate will accumulate at interfaces, with the hydrophobic part of the molecule in the nonaqueous phase and the hydrophilic part in the aqueous phase. Further work is necessary to determine the importance of this mechanism in experiments with natural sorbents. (Doria-PTT)
W87-02730

RETARDATION OF TOXIC CHEMICALS IN A CONTAMINATED OUTWASH AQUIFER,
National Hydrology Research Inst., Ottawa (Ontario).
R. J. Patterson, R. E. Jackson, B. W. Graham, D. Chaput, and M. Priddle.
Water Science and Technology WSTED4, Vol. 17, No. 9, p 57-69, September 1985. 5 fig, 1 tab, 10 ref.

Descriptors: *Path of pollutants, *Retardance, *Fate of pollutants, *Groundwater pollution, *Contamination, *Outwash, *Aquifers, Organic compounds, Water pollution, Drinking water, Landfills, Waste disposal, Physicochemical properties, Mathematical studies, Sorption.

Organic chemicals disposed between 1969 and 1980 in a 'Special Waste Compound' at the Gloucester Landfill near Ottawa, Canada are migrating through a confined outwash aquifer. The subsurface distribution of the chemicals down-gradient from the disposal site suggests that the major process controlling migration is chromatographic dispersion (aqueous phase solute transport plus sorption). Retardation factors calculated on the basis of relative lengths of contaminant plumes agree closely with those determined independently during a purge-well test and indicate a linear relationship with the logarithm of the octanol/water partition coefficient. The slope of this relationship (0.50) is at the low end of the range of values reported for other expressions of the same form determined from laboratory experiments. This lower slope may reflect the fact that in aquifers flow is predominantly through the coarser, less organic-rich units. The relatively low range of partition coefficient values (log -0.27 to 2.83) represented by the contaminants may also be a factor contributing to a smaller slope value. (Author's abstract)
W87-02731

BIODEGRADATION OF METHANOL AND TERTIARY BUTYL ALCOHOL IN SUBSURFACE SYSTEMS,
Virginia Polytechnic Inst. and State Univ., Blacksburg. Dept. of Civil Engineering.
J. T. Novak, C. D. Goldsmith, R. E. Benoit, and J. H. O'Brien.
Water Science and Technology WSTED4, Vol. 17, No. 9, p 71-85, September 1985. 17 fig, 4 tab, 6 ref.

Descriptors: *Biodegradation, *Methanol, *Alcohols, *Subsurface water, *Fate of pollutants, Soil bacteria, Degradation, Groundwater, Gasoline, Anaerobic digestion, Microbial degradation, Chemical properties, Chemical reactions.

Soils were obtained from three sites for microcosm studies to determine if and at what rate gasoline-based alcohols would be degraded in subsurface systems. Bacterial populations were significant at all depths to 31 m by both acridine-orange and soil extract counts. Methanol degraded at all sites up to a concentration of 1,000 mg/L such that contamination would be reduced to non-measurable levels in one year or less. Tertiary butyl alcohol (TBA) was more refractory but was biodegraded at all sites. Degradation rates at anaerobic sites varied directly with the TBA concentration. The presence of TBA or TBA and benzene, toluene, and xylene (BTX) had no effect on methanol degradation, nor were TBA degradation rates affected by the presence of methanol or methanol and BTX. The data suggest that methanol contamination problems in groundwater should be minimal because of its susceptibility to biodegradation. TBA may be more persistent but should also degrade. (Author's abstract)
W87-02732

TRANSPORT OF SOLUTES IN SOIL: BASIC FEATURES OF FRONT RETARDATION,
Agricultural Univ., Wageningen (Netherlands). Dept. of Soil Science and Geology.
G. H. Bolt.
Water Science and Technology WSTED4, Vol. 17, No. 9, p 87-99, September 1985. 4 fig, 18 ref.

Descriptors: *Retardance, *Soil properties, *Path of pollutants, *Solute transport, *Solutes, *Adsorption, Mathematical studies, Leaching, Chromatography, Physicochemical properties.

Application of the integral conservation equation to a moving concentration front provides the basis for calculation of its mean rate of movement. Doing so shows that the simultaneous presence of different adsorbates exhibiting differing adsorption isotherms leads to the formation of a corresponding number of concentration fronts separated by a transition region. In this region, concentration levels in excess of those occurring in both the feed solution and in the initial solution phase are characteristic. A similar reasoning applies to the situation

where an incoming solute in the mobile solution phase is subject to the formation of a precipitate with an ion driven off the solid phase by an also incoming competitor for adsorption sites on the solid phase. In addition, excessive concentration levels are shown to arise occasionally in the transition zone between the precipitation and dissolution fronts. The effect of a delayed equilibration between the mobile and an immobile (adsorbing) phase is discussed briefly. (Author's abstract)
W87-02733

ORGANIC AND TRACE METAL LEVELS IN OCEAN QUAHOG, ARCTICA ISLANDICA LINNE, FROM THE NORTHWESTERN ATLANTIC,
National Marine Fisheries Service, Highlands, NJ. Sandy Hook Lab.
F. W. Steimle, P. D. Boehm, V. S. Zdanowicz, and R. A. Bruno.
Fishery Bulletin FSYBAY, Vol. 84, No. 1, p 133-140, 1986. 1 fig, 4 tab, 26 ref.

Descriptors: *Path of pollutants, *Trace metals, *Organic compounds, *Pollutant identification, *Clams, *Atlantic Ocean, Mollusks, Marine environment, Polychlorinated biphenyls, Hydrocarbons, Monitoring, Water pollution, Resources management, Contamination, Silver, Cadmium, Chromium, Copper, Nickel, Lead, Metals, Zinc.

Body burden levels of several contaminants were investigated in a resource species, the ocean quahog, collected between Virginia and Nova Scotia. Contaminants included polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs) of both petroleum and combustion sources, total petroleum hydrocarbons, and seven trace metals (silver, cadmium, chromium, copper, nickel, lead, and zinc). Organic and trace metal contaminants were detected at low levels in all samples, with highest levels generally occurring in samples from the inner New York bight and Rhode Island Sound. The highest PCB and PAH values were 27 and 55 ppb, respectively; silver, cadmium, and chromium values were generally less than 5 micrograms per gram dry weight; copper, nickel, and lead generally were less than 15 micrograms per gram dry weight (with a few exceptions); and zinc ranged from 50 to 153 micrograms per gram dry weight. (Doria-PTT)
W87-02759

STUDY OF ACID DEPOSITION IN SWITZERLAND: TEMPORAL VARIATION IN THE IONIC COMPOSITION OF WET PRECIPITATION AT RURAL SITES DURING 1983-1984,
Bern Univ. (Switzerland). Inst. of Plant Physiology
J. Fuhrer.
Environmental Pollution (Series B) EPSPDH, Vol. 12, No. 2, p 111-129, 1986. 4 fig, 3 tab, 35 ref.

Descriptors: *Acid rain, *Rainfall, *Switzerland, *Temporal variation, *Rural areas, *Chemistry of precipitation, *Urban areas, Seasonal variation, Chemical properties, Ions, Precipitation, Spatial distribution, Cations, Anions, Weather patterns, Nitrates, Sulfates, Chlorides, Ammonium compounds.

The chemical characteristics of wet precipitation in Switzerland were studied. At sites not under the direct influence of urban emissions, concentrations of sulfate, nitrate, and chloride were very similar at altitudes of 515 and 950 m above sea level. Volume-weighted average concentrations observed were lower than at most other European sites. Between 950 and 3500 m above sea level, concentrations decreased, but much less in the case of sulfate than in the case of nitrate. At sites surrounded by agriculture, most nitrate and sulfate was associated with ammonium and not with hydrogen ions. Anionic acids were enriched in precipitation collected downwind of urban areas. The temporal variation in the concentration of sulfate and nitrate did not depend on location, but was determined by precipitation volume and seasonal factors; for example, the increase in air temperature in spring, which was associated with an increase in sulfate. The most acidic events occurred during spring and summer months, and were characterized by an increase in the nitric acid content. Possible relationships between the variation in precipitation acidity and meteorological conditions are discussed. (Author's abstract)
W87-02763

METAL CONCENTRATIONS IN THE ANNUAL SHELL LAYERS OF THE BIVALVE ELLIPTIO COMPLANATA,
Department of Fisheries and Oceans, Burlington (Ontario). Great Lakes Fisheries Research Branch.
R. M. Dermott, and K. R. Lum.
Environmental Pollution (Series B) EPSPDH, Vol. 12, No. 2, p 131-143, 1986. 1 fig, 5 tab, 19 ref.

Descriptors: *Heavy metals, *Path of pollutants, *Great Lakes, *Clams, *Bioindicators, *Contamination, Mollusks, Indicators, Metals, Aluminim, Copper, Iron, Nickel, Lead, Zinc, Industrial wastewater, Manganese.

Levels of four metals were measured in the shells of Elliptio complanata collected from three localities in the Great Lakes having widely different levels of contamination. Concentrations of 10 metals were measured in the outermost shell and overlying periostracum cut from each of the annual rings of two shells. Zn (unlike Pb) displayed a much greater affinity for the soft tissues than for the shell. Levels of Al, Cu, Fe, Ni, Pb, and Zn were significantly higher in the outer periostracum of the shell than in the inorganic prismatic shell layer. In spite of high Pb levels in industrial effluent at one of the locations, inorganic Pb was not deposited in the prismatic shell layer. Metal concentrations in the periostracum did not follow the chronological trends in the prismatic layer. Levels of Al, Fe, and Mn decreased with clam age, whereas concentrations of Cu and Zn were greatest during years of fastest growth. (Author's abstract)
W87-02764

NITRILOTRIACETIC ACID IN SLUDGE-AMENDED SOIL: MOBILITY AND EFFECTS ON METAL SOLUBILITY,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
For primary bibliographic entry see Field 5E.
W87-02765

HUMAN VIRUSES IN SEDIMENTS, SLUDGES, AND SOILS,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
V. C. Rao, T. G. Metcalf, and J. L. Melnick.
Bulletin of the World Health Organization BWHOA6, Vol. 64, No. 1, p 1-14, 1986. 3 fig, 6 tab, 33 ref.

Descriptors: *Viruses, *Sediments, *Sludge, *Soil environment, *Wastewater disposal, *Waste disposal, *Human diseases, *Public health, *Path of pollutants, Water pollution, Enteroviruses, Land disposal, Wastewater, Diseases, Environment, Pathogens, Bioaccumulation, Accumulation, Potable water.

Recent studies on the movement of viruses in the environment have focused on solids-associated viruses in wastewater discharged into the ocean and on viruses in sludge and wastewater retained in soil following land disposal. Such disposal may result in a discharge of one or more of 120 human enteric virus pathogens including those causing poliomyelitis, viral hepatitis A, and acute gastroenteritis. Solids-associated viruses in effluents discharged into coastal waters accumulate in bottom sediments, which may contain 10 to 10,000 more virus per unit volume than the overlying seawater. Solids-associated viruses resuspended by water turbulence may be transported to distant recreational or shellfish-growing water. Transmission of viruses causing hepatitis or gastroenteritis may result from contact by bathers or swimmers with these viruses in recreational waters, or from ingestion of raw or improperly cooked shellfish in which the solids-associated virus had been bioaccumulated. The land disposal of sludge and wastewater may cause infections in farm workers, contamination of crops, pollution of raw potable water sources, or infiltration of ground water. Viruses retained on soils can be released by rain water and may contaminate ground water through lateral and vertical movements. (Author's abstract)
W87-02768

CONCENTRATIONS OF 20 VOLATILE ORGANIC COMPOUNDS IN THE AIR AND DRINKING WATER OF 350 RESIDENTS OF NEW JERSEY COMPARED WITH CONCENTRATIONS IN THEIR EXHALED BREATH,
Environmental Protection Agency, Washington, DC.
L. Wallace, E. Pellizzari, T. Hartwell, H. Zelon, and C. Sparacino.
Journal of Occupational Medicine, Vol. 28, No. 8, p 603-608, August 1986. 5 tab, 16 ref.

Descriptors: *Organic compounds, *Air pollution, *Water pollution, *Drinking water, *New Jersey, *Monitoring, Chlorinated hydrocarbons, Hydrocarbons, Chloroform, Aromatic compounds.

Twenty volatile organic compounds were measured in the personal air and drinking water of 350 New Jersey residents in the fall of 1981. Two consecutive 12-hour integrated personal air samples and two tap water samples were collected from each participant. At the end of the 24-hour monitoring period, each participant supplied a sample of exhaled breath. Simultaneous outdoor samples were collected in 100 residential locations in two cities. Eleven compounds were commonly present in air, but only four (the trihalomethanes) in water. Wide ranges of exposures (three to four orders of magnitude) were noted for most compounds. Ten of 11 compounds displayed significant correlations between air exposures and breath concentrations, while chloroform levels were correlated with drinking water exposures. It was concluded that breath measurements are a feasible, cost-effective, and highly sensitive way to determine environmental and occupational exposures to volatile organic compounds. (Author's abstract)
W87-02774

SANITARY STUDY OF SURFACE WATER AND OF THE BEACH OF A WATER SPORTS AND LEISURE COMPLEX,
Service des Maladies Parasitaires et Exotiques, Angers (France).
D. Chabasse, P. Laine, A. M. Simitzis-le-Flohic, B. Martineau, and M. El Hourch.
The Journal of Hygiene JOHYAY, Vol. 96, No. 3, p 393-401, June 1986. 1 fig, 5 tab, 34 ref.

Descriptors: *Sanitation, *Public health, *Surface water, *Beaches, *Recreation, *Microbiological studies, Parasites, Water pollution, Bacteria, Aquatic bacteria, Bacterial analysis, Water analysis, Aquatic fungi, Fungi, Physicochemical properties, Lakes, Protozoa, Seasonal distribution, Distribution, Sand, Hydrology, Monitoring.

Parasitological, bacteriological, mycological, and physicochemical data were obtained from both surface water and beach sand of a lake used for water sports. Results show that the lake is contaminated in both winter and spring by water which overflows from the River Maine, and is self-purified by a mechanism of 'lagunage'. In the summer, signs of pollution are at their lowest level, although use of the complex is at its peak. Conversely, the amoebic flora, which is independent of the usual criteria of pollution, predominates in summer, and serves as a marker for the need for increased surveillance. The beach sand presents no apparent infectious hazard. Environmental pressure will undoubtedly change these data over a period of time, and further monitoring is planned. (Author's abstract)
W87-02777

CONTAMINATING PEPTIDES WIDELY PRESENT IN ION-EXCHANGED WATER, REAGENTS, EXPERIMENTAL IMPLEMENTS AND NATURAL SAMPLE,

Azabu Univ., Sagamihara (Japan). Faculty of General Education.
T. Samata, and M. Matsuda.
Comparative Biochemistry and Physiology CBPCB5, Vol. 84B, No. 4, p 531-535, August 1986. 3 fig, 4 tab, 8 ref.

Descriptors: *Contamination, *Peptides, *Ion exchange, *Reagents, *Chemical analysis, Chemical interference, Water analysis, Amino acids, Laboratory equipment, Municipal water, Serine, Glycine, Alanine, Ornithine.

Ion-exchanged water, various reagents, dialysis tubing, filter paper, and tap water were found to be widely contaminated by certain kinds of peptides with molecular weights between 1,000 and 6,000 daltons. Amino acid analysis showed them to contain serine, glycine, and alanine as the three major amino acid components, constituting about 50% of the total amino acid in the contaminants; ornithine is also a common constituent. The significance of the presence of ornithine and the origin of the contaminants are discussed. (Author's abstract)
W87-02787

MORE AWARENESS SOUGHT CONCERNING ROLE OF METALS IN POLLUTION,
J. Haggin.
Chemical and Engineering News CENEAR, Vol. 64, No. 36, p 37-38, September 1986.

Descriptors: *Metals, *Environmental policy, *Resources management, *Environmental protection, *Technology, Protection, Environmental control, Heavy metals, Cadmium, Industrial wastes, Mine wastes, Farm wastes, Public policy, Regulation.

Environmental pollution by metals poses unique problems due to general ignorance of the environment, the intractable nature of the metals themselves, and often inept regulatory efforts. Some metals have effects that are highly localized, whereas others have more general effects. Cadmium is discussed as an example to illustrate the problems of metals pollution. It is concluded that otherwise acceptable disposal means, such as incineration, wastewater treatment, and composting, may be unacceptable because of the threat of metals accumulation over time. Another reason to be concerned with metals disposal is the need for conservation of resources. Chemical technology must find more sophisticated ways to exploit the same principles and processes that regulate metals in rocks, seas, and biota. (Doria-PTT)
W87-02791

STUDIES ON SEDIMENTS OF THE RIVER LAHN: 1. ANALYTICAL RESULTS, (UNTERSUCHUNGEN AN LAHNSEDIMENTEN: 1. ANALYTISCHE ERGEBNISSE),
Marburg Univ. (Germany, F.R.). Fachbereich Chemie.
W. Spickermann, and G. Stork.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 323, No. 1, p 33-37, January 1986. 6 fig, 1 tab, 24 ref.

Descriptors: *Chemical analysis, *Soil chemistry, *Geochemistry, *Heavy metals, *River Lahn, Rivers, Mercury, Cadmium, Lead, Copper, Metals, Particle size, Chemical properties, Carbon, Organic carbon, Acidity, Soil types, Carbonates, Statistical analysis.

The metals mercury, cadmium, lead, and copper were determined in 40 samples of sediments from the river Lahn. The sediments were characterized by geochemical properties (contents of carbonate, organic carbon, iron, manganese, and values of pH and E sub h). Grain size distributions of the sediments were calculated. The contents of sand, silt, and clay were derived from these curves. Statistical parameters describing the distribution curves are presented. (See also W87-02801) (Author's abstract)
W87-02800

STUDIES ON SEDIMENTS OF THE RIVER LAHN: 2. CHEMOMETRIC EVALUATION, (UNTERSUCHUNGEN AN LAHNSEDIMENTEN: 2. CHEMOMETRISCHE AUSWERTUNG),
Marburg Univ. (Germany, F.R.). Fachbereich Chemie.
W. Spickermann, and G. Stork.
Fresenius' Zeitschrift fuer Analytische Chemie ZACFAU, Vol. 323, No. 1, p 38-43, January 1986. 1 fig, 5 tab, 26 ref.

Descriptors: *River Lahn, *Sediments, *Soil chemistry, *Heavy metals, *Chemical properties, Statistical methods, Statistical analysis, Mathematical studies, Chemical reactions, Cations, Ion exchange, Organic compounds, Adsorption, Hydroxides.

The analytical results of investigations on 40 samples of sediments of the river Lahn were evaluated by multivariate statistical methods, including multile correlation analysis, factor analysis, cluster analysis, and multiple regression analysis. This approach provided information about the relative importance of the different types of bonding (bonding by organic substances, hydroxides, and carbonates, and by cation-exchange and adsorption) for the toxic heavy metals copper, mercury, cadmium, and lead in the sediments of the river Lahn. (See also W87-02800) (Author's abstract)
W87-02801

LAKE ACIDIFICATION AND THE LAND-USE HYPOTHESIS: A MID-POST-GLACIAL ANALOGUE,
University Coll., London (England). Palaeoecology Research Unit.
For primary bibliographic entry see Field 2K.
W87-02810

MEASUREMENTS OF PH VERSUS DROP SIZE IN NATURAL RAIN,
Auckland Univ. (New Zealand). Dept. of Physics.
For primary bibliographic entry see Field 2B.
W87-02811

TEMPORAL EVOLUTION OF NITROGEN COMPOUNDS IN SWEDISH PRECIPITATION SINCE 1955,
Stockholm Univ. (Sweden). Meteorologiska Institutionen.
For primary bibliographic entry see Field 2B.
W87-02812

SALMONELLAE AND POLLUTION INDICATOR BACTERIA IN MUNICIPAL AND FOOD PROCESSING EFFLUENTS AND THE CORNWALLIS RIVER,
Environmental Protection Service, Dartmouth (Nova Scotia).
For primary bibliographic entry see Field 5D.
W87-02815

DEVELOPING MANAGEMENT GUIDELINES FOR RIVER NITROGENOUS OXYGEN DEMAND,
Ministry of Works and Development, Hamilton (New Zealand). Water Quality Centre.
For primary bibliographic entry see Field 5G.
W87-02822

MEDICAL GEOLOGY,
Brooklyn Coll., NY. Dept. of Geology.
For primary bibliographic entry see Field 5C.
W87-02825

PUBLIC POLICY IMPLICATIONS OF TOXIC CHEMICALS IN DRINKING WATER: A CASE STUDY OF LONG ISLAND, NY,
New York Public Interest Research Group, Inc., NY.
For primary bibliographic entry see Field 5C.
W87-02826

GROUNDWATER CONTAMINATION WITH SYNTHETIC ORGANIC COMPOUNDS AND PESTICIDES IN SUFFOLK COUNTY,
Suffolk County Dept. of Public Health, Hauppauge, NY.
M. H. Zaki.
Northeastern Environmental Science, Vol. 5, No. 1/2, p 15-22, 1986. 2 fig, 5 tab, 7 ref.

Descriptors: *Water pollution sources, *Organic compounds, *Pesticides, *Groundwater pollution, Aldicarb, Chlorinated hydrocarbons, Public health, Suffolk County, New York, Wells, Municipal water, Water quality standards.

Groundwater monitoring was initiated in Suffolk County, N. Y., after a 1976 survey showed that synthetic organic compounds were present in groundwater of neighboring Nassau County. More than 25,000 water samples have been analyzed. Results showed that 3.5% of community water systems and 3.8% of non-community water systems and private wells contained synthetic organic compounds above the guidelines recommended by the State of New York (50 ppb for individual chemicals and 100 ppb for the aggregate). Among these chemicals were 1,1,1-trichloroethane, 1,1-dichlorethane, 1,1,2-trichloroethylene, tetrachloroethylene, and 1,2-dichloropropane. Levels of the pesticide aldicarb exceeded the 7-ppb guideline in 13.3% of the 8404 wells tested. (Cassar-PTT)
W87-02827

MANAGING THE INDUSTRIAL/HAZARDOUS CONTRIBUTIONS TO THE NIAGARA RIVER,
New York State Dept. of Environmental Conservation, Albany.
For primary bibliographic entry see Field 5G.
W87-02828

ENVIRONMENTAL IMPACT OF OIL SPILLS AND THE OIL INDUSTRY RESPONSE,
Texaco, Inc., Beacon, NY.
For primary bibliographic entry see Field 5C.
W87-02829

PHYSIOLOGICAL INNOCUITY OF ASBESTOS IN WATER,
Societe Nationale de l'Amiante, Sherbrook (Quebec).
For primary bibliographic entry see Field 5C.
W87-02831

TOXIC SUBSTANCES, RISK MANAGEMENT AND NEW YORK STATE DRINKING WATER,
New York State Dept. of Health, Albany.
L. J. Hetling, and K. J. Markussen.
Northeastern Environmental Science, Vol. 5, No. 1/2, p 71-83, 1986. 11 tab, 8 ref.

Descriptors: *Water pollution control, *Water pollution sources, *Drinking water, *Organic compounds, *New York, *Water quality control, Risk, Chlorinated hydrocarbons, Wells.

New York State's drinking water quality with respect to toxic organic chemicals is reviewed. In a 1981 survey, samples from 69 community water systems were tested for 43 compounds. Positive results were found in 4% of the tests. Sixteen of the 43 organic chemicals were present in 39 of the total number of water systems. Chemicals were classified as follows: purgeable halocarbons, 23 systems positive; purgeable aromatics, 6 systems; trihalomethanes, 25 systems; polychlorinated biphenyls, 1 system; pesticides, not detected. A list of wells closed because of contamination shows the following sources of pollutants: unidentified, 35 wells; industrial/commercial discharges, 24 wells; landfills, 7 wells; fuel tanks, 4 wells; and agricultural applications, 4 wells. Of bottled water samples distributed in the state, 68% contained detectable organic chemicals, all at levels below guidelines. The risk assessment and management program is described. Its goal is to immediately reduce the level of the compound(s) to below guideline levels and to eventually eliminate the substance completely. Four case studies are described: A - trichloroethene contamination, B - benzene, 1,2-dichloroethene, and vinyl chloride contamination, C - vinyl chloride contamination, and D - trichloroeth-

ene and tetrachloroethene contamination. (Cassar-PTT)
W87-02832

HEALTH EFFECTS OF ARSENIC IN THE AQUEOUS ENVIRONMENT,
Texas A and M Univ., College Station. Center for Energy and Mineral Resources.
For primary bibliographic entry see Field 5C.
W87-02833

VERTICAL TRANSPORT AND FATE OF LOW-WATER-SOLUBILITY CHEMICALS IN UNSATURATED SOILS,
Oregon State Univ., Corvallis. Dept. of Mathematics.
F. T. Lindstrom, and W. T. Piver.
Journal of Hydrology JHYDA7, Vol. 82, No. 1/2, p 93-141, November 30, 1985. 22 fig,11 tab,22 ref,append. NIEHS Grants ES00040,ES00210;NIEHS consulting contract 8324080-211.

Descriptors: *Path of pollutants, *Soil chemistry, *Fate of pollutants, *Solute transport, *Model studies, *Physicochemical properties, Soil columns, Soil water, Temperature, Weather, Hydraulic properties, Adsorption, Dispersion.

Adsorption, dispersion, and changes in moisture content control the rate of solute transport in an unsaturated soil column. A one-dimensional mathematical model was developed to investigate the simultaneous transport of heat, moisture, and chemical mass in unsaturated soils. Chemical concentration is assumed to be low. The field equation for chemical transpo is strongly coupled to the field equations for moisture content and temperature, while the converse is not true. Vertical temperature, moisture content, and chemical concentration profiles were determined using the iterative Thomas algorithm procedure on implicit backward difference aproximations to the defining set of nonlinear partial differential equation For a specified set of hydraulic properties, initial distributions of chemic in the soil column, and external weather conditions, chemical concentration profiles for 100-days simulations illustrated the influence of the combi effects of adsorption and dispersion on chemical transport in unsaturated soils. (Author's abstract)
W87-02836

MODEL SIMULATION OF SOLUTE LEACHING AND ITS APPLICATION FOR ESTIMATING THE NET RATE OF NITRATE FORMATION UNDER FIELD CONDITIONS,
National Inst. for Environmental Studies, Tsukuba (Japan). Systems Analysis and Planning Div.
S. Otoma, and T. Kuboi.
Journal of Hydrology JHYDA7, Vol. 82, No. 3/4, p 193-209, December 30, 1985. 13 fig, 1 tab, 13 ref.

Descriptors: *Sludge disposal, *Land disposal, *Path of pollutants, *Model studies, *Simulation, *Solute transport, *Leaching, Estimating, *Nitrates, *Nitrogen cycle, *Groundwater pollution, *Fate of pollutants, Soil solution, Leachates, Soil water, Infiltration, Chlorides, Model testing, Adsorption, Rainfall, Nitrogen compounds, Prediction, Field tests.

A model of the discrete type to describe unsteady infiltrations and redistributions of water and solutes in the upper 100 cm of saturated soil was developed. The model was evaluated by comparing the measurements of the changes in chloride concentration in the field soil amended with sewage sludge with those obtained by simulation. The simulations showed that the amount of chloride adsorbed in the field was as little as 60% of that measured in the flask of the batch test, and that most of the chloride leached quickly through the upper zone of soil (0-20 cm) but stagnated in the lower zone (20-100 cm). The model was applied for estimating the daily net rate of nitrate formation. The rate was accelerated remarkably by rainfall and abruptly slowed down soon after, but did not correlate well with soil water content or temperature. The change in the rate could not be measured directly in the field, since the sampling of a soil core disturbs the natural field conditions. The model was applicable to this kind of estimation as well as to prediction of infiltration and redistribution of components in the soil solution. (Author's abstract)
W87-02839

EFFECT OF SOIL AND EFFLUENT CHARACTERISTICS ON PHOSPHORUS SORPTION IN DOSED COLUMNS,
British Columbia Ministry of Environment, Victoria.
For primary bibliographic entry see Field 2G.
W87-02861

MODELING LEACHATE PRODUCTION FROM MUNICIPAL LANDFILLS,
Rutgers - The State Univ., Piscataway, NJ. Dept. of Civil and Environmental Engineering.
A. C. Demetracopoulos, L. Sehayek, and H. Erdogan.
Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 5, 849-866, October 1986. 14 fig, 27 ref.

Descriptors: *Municipal landfills, *Water pollution sources, *Leaching, *Modeling, *Path of pollutants, *Groundwater pollution, Organic matter, Mathematical models, Prediction, Mass release, Solute transport, Equations, Hydrologic budget, Design, Pollutants, Landfills.

A mathematical model for the generation and transport of solute contaminants through a solid waste landfill is presented. The governing equations are solved numerically by the method of lines. A sensitivity analysis of the model showed that care must be exercised in the selection of the time step Delta t and the grid size Delta z. It was also shown that the biokinetics of the system and the term describing mass transfer from the solid to the liquid phase have a pronounced effect on the resulting concentration histories. Further experimental work for determination of these parameters is needed. The model output agrees qualitatively with measurements of concentration, in that it produces a hydrograph-like contaminant concentration history at the landfill bottom. (Author's abstract)
W87-02883

MODELING OF POLLUTANT DISPERSION IN STRATIFIED OSCILLATORY FLOWS,
California Univ., Berkeley. Sanitary Engineering Research Lab.
J. K. Park, and A. James.
Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 5, 921-938, October 1986. 11 fig, 2 tab, 25 ref.

Descriptors: *Pollutant dispersion, *Mathematical models, *Estuaries, *Tidal effects, *Oscillatory flow, Path of pollutants, Stratification, Mass transport, Turbulent flow, Equations, Spatial averaging, Longitudinal dispersion, Velocity, Shear effect, Vertical shear, Transverse shear, Predictions, Field tests, Tidal oscillation, Analytical studies, Salinity, Tyne estuary.

A model is presented for predicting the rate of longitudinal dispersion in nonhomogeneous oscillatory flows. The model consists of mathematical representations of velocity and salinity over a cross section and their application to the classical definition of the longitudinal dispersion coefficient. Velocity and salinity data collected over 2 years in the Tyne estuary were analyzed for investigating principal factors controlling longitudinal dispersion. The results indicate that the model can simulate dispersive flux directly in an estuary and can be applied to a water quality model. (Author's abstract)
W87-02885

SLACK TIDE OXYGEN BALANCE MODEL,
Imperial Coll. of Science and Technology, London (England). Dept. of Civil Engineering.
J. H. W. Lee, and K. W. Choi.
Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 5, 985-991, October 1986. 4 fig, 1 tab, 5 ref.

Descriptors: *Path of pollutants, *Model studies, *Tidal effects, *Slack tide, *Oxygen balance models, *Estuarine pollution, Water quality, Tidal waters, Anoxic conditions, Biological oxygen demand, Dissolved oxygen, Steady state equations, Numerical solutions.

In the study of estuarine pollution, the slack tide model can be very effective and may often be the only model that is compatible with the available hydrographic and water quality data. For heavily polluted tidal waters, the oxygen balance under anoxic conditions (not including nitrification) can be formulated as a model; a successful application of this model has recently been reported. A computational difficulty in incorporating such an oxygen balance formulation in a slack tide mixed segment model for the determination of the quasi-steady BOD/DO distribution in a tidal river is examined. Under anoxic conditions, the governing steady state equations cannot be relied upon to give the steady state response. Instead, a numerical solution of an equivalent time-dependent oxygen balance model is preferred. The accuracy of the solution depends upon the geometric schematization of the estuary, the magnitude of the dispersion coefficients, the pollution loading, and secondarily on the rate coefficients and exact solution algorithm. (Alexander-PTT)
W87-02889

BACTERIA ASSOCIATED WITH GRANULAR ACTIVATED CARBON PARTICLES IN DRINKING WATER,
Montana State Univ., Bozeman. Dept. of Microbiology.
A. K. Camper, M. W. LeChevallier, S. C. Broadaway, and G. A. McFeters.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 3, p 434-438, September 1986. 1 fig, 5 tab, 28 ref. EPA Grant CR810015.

Descriptors: *Bacteria, *Activated carbon, *Drinking water, *Trihalomethanes, Bacterial growth, Tastes, Odors, Microorganisms, Chlorination, Potable water, Filters, Water quality, Contamination, Treatment barriers.

Carbon particles can penetrate treatment barriers and enter finished drinking water. The development and use of a gauze filter/Swinnex sampling technique permitted the examination of large volumes of filtered drinking water for carbon fines. The filter was used to collect carbon fines from 201 granular activated-carbon treated drinking water samples over 12 months. Application of a homogenization procedure indicated that 41.4% of the water samples had heterotrophic plate count bacteria attached to carbon particles. With the enumeration procedures developed, heterotrophic plate count bacteria were recovered at a rate of 8.6 times higher than by conventional analyses. Over 17% of the samples contained carbon particles colonized with coliform bacteria as enumerated with most-probable-number and membrane filter techniques. In some instances coliform recoveries were 122 to 1194 times higher than by standard procedures. Nearly 28% of the coliforms attached to the particles exhibited the fecal biotype. Scanning electron micrographs of carbon fines showed microcolonies of bacteria on particle surfaces. The data indicate that bacteria attached to carbon fines may be an important mechanism by which microorganisms penetrate treatment barriers and enter potable water supplies. (Alexander-PTT)
W87-02891

MECHANISM OF INACTIVATION OF ENTERIC VIRUSES IN FRESH WATER,
James N. Gamble Inst. of Medical Research, Cincinnati, OH.
R. L. Ward, D. R. Knowlton, and P. E. Winston.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 3, p 450-459, September 1986. 8 fig, 4 tab, 30 ref.

Descriptors: *Inactivation, *Enteroviruses, *Freshwater, Transmission, Disease, Diarrhea, Incubation, River water, Turbidity, Enzymes, Temperature, Health hazards, Inactivation rate, Radiotracers.

The ability to cause inactivation of enteric viruses appears to be a general property of fresh water. Although waters collected from different sources have been shown to have different amounts of virucidal activity, the only property of fresh water that has consistently related to virucidal activity is temperature. Fresh water from 9 sources caused inactivation of poliovirus. Further testing with 4 of the samples showed that enteric viruses from different genera were consistently inactivated in those freshwater samples. Studies on the cause of inactivation were conducted with echovirus type 12 as the model virus. The results revealed that the virucidal agents in the waters tested could not be separated from microorganisms. Any treatment that removed or inactivated microorganisms caused loss of virucidal activity. Microbial growth in a sterilized creek water seeded with a small amount of stream water resulted in concomitant production of virucidal activity. Active and inactive isolates were represented by both Gram-positive and Gram-negative organisms. Examination of echoviruses inactivated in stream water revealed the loss of infectivity first correlated with a slight decrease in sedimentation coefficient of virus particles. The cause appeared to be cleavage of viral proteins, most notably, VP-4 and, to a lesser extent, VP-1. Viral RNA associated with particles was also cleaved but the rate was slower than loss of infectivity. The results suggest that proteolytic bacterial enzymes inactivate echovirus particles in fresh water by cleavage of viral proteins, thus exposing the viral RNA to nuclease digestion. (Alexander-PTT)
W87-02893

USE OF GEOSTATISTICS TO PREDICT VIRUS DECAY RATES FOR DETERMINATION OF SEPTIC TANK SETBACK DISTANCES,
Arizona Univ., Tucson. Dept. of Microbiology and Immunology.
M. V. Yates, S. R. Yates, A. W. Warrick, and C. P. Gerba.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 3, p 479-483, September 1986. 5 fig, 27 ref.

Descriptors: *Statistical methods, *Wells, *Water pollution sources, *Septic tanks, *Viruses, *Drinking water, *Water quality, Human diseases, Etiology, Rotaviruses, Cultivation, Discharge, Wastewater, Subsurface water, Groundwater pollution, Effluents, Soil adsorption field, Dye tracers, Kriging, Public health.

Water samples were collected from 71 public drinking-water supply wells in the Tucson, AZ basin. Virus decay rates in the water samples was determined with MS-2 coliphage as a model virus. The correlations between the virus decay rat and the sample locations was shown by fitting a spherical model to the experimental semivariogram. Kriging, a geostatistical technique, was used to calculate virus decay rates at unsampled locations by using the known values at nearby wells. Based on the regional characteristics of groundwater flow and the kriged estimates of virus decay rates, a contour map of the area was constructed. The map shows the variation in separation distances that would have to be maintained between wells and sources of contamination to afford similar degrees of protection from viral contamination of the drinking water in the wells throughout the basin. (Author's abstract)
W87-02895

DEVELOPMENT OF A METHOD FOR CONCENTRATION OF ROTAVIRUS AND ITS APPLICATION TO RECOVERY OF ROTAVIRUSES FROM ESTUARINE WATERS,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
For primary bibliographic entry see Field 5A.
W87-02896

DECOMPOSITION STUDIES IN TWO CENTRAL ONTARIO LAKES HAVING SURFICIAL PHS OF 4.6 AND 6.6,
Toronto Univ. (Ontario). Dept. of Microbiology.
For primary bibliographic entry see Field 2H.
W87-02897

VIABLE BUT NONCULTURABLE STAGE OF CAMPYLOBACTER JEJUNI AND ITS ROLE IN SURVIVAL IN THE NATURAL AQUATIC ENVIRONMENT,
Maryland Univ., College Park. Dept. of Microbiology.
D. M. Rollins, and R. R. Colwell.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 3, p 531-538, September 1986. 5 fig, 32 ref. Agency for International Development Grant DPE-5542-G-SS-4060-00; NSF Grant BSR-84-01397; WHO Grant C6/181/70; NIH Public Health Service Grant R22 A114141-0742; and Naval Medical Research Inst. work unit 61102A 3M661128S10.AB422.

Descriptors: *Aquatic environment, *Natural waters, *Path of pollutants, *Culturing techniques, *Campylobacter, Isolation, Pathogens, Epidemiology, Contamination, Feces, Microcosms, Plate counts, Aeration, Morphology, Survival, Temperature effects, Culture media, Human diseases, Bacterial physiology.

Conditions influencing the survival of Campylobacter jejuni in the natural aquatic environment have been determined. Release into natural waters by animal hosts is postulated to play a key role in the maintenance of viability and the transmission of the organism in the environment. Laboratory flask microcosms containing filter-sterilized stream water were used to test C jejuni for the ability to remain viable in simulated natural systems. The microcosms were compared with the biphasic and shaking broth procedures used routinely. The microcosms were analyzed to determine effects of temperature, and aeration on the survival of a well-characterized C jejuni strain. Morphological characteristics were evaluated. Survival curves were quantified on the basis of plate counts and other methods. In all cases, increasing temperature of cultivation resulted in decreased recoverability on laboratory media. Stream water held at 4 C sustained significant numbers of campylobacters for > 4 months. Microcosms, aerated with shaking, exhibited logarithmic decline in recoverable C jejuni, while stationary systems underwent a more moderate rate of decrease. The nonculturable state of Campylobacter spp holds serious epidemiological implications and requires a re-evaluation of methods used to detect or monitor this organism in the environmental samples. (Author's abstract)
W87-02899

BIOACCUMULATION OF ARSENIC BY FRESHWATER ALGAE AND THE APPLICATION TO THE REMOVAL OF INORGANIC ARSENIC FROM AN AQUEOUS PHASE: PART II. BY CHLORELLA VULGARIS ISOLATED FROM ARSENIC-POLLUTED ENVIRONMENT,
Kagoshima Univ. (Japan). Dept. of Applied Chemistry.
S. Maeda, S. Nakashima, T. Takeshita, and S. Higashi.
Separation Science and Technology SSTEDS, Vol.20, No. 2 and 3, p 153-161, April-May 1985. 2 fig, 6 tab, 8 ref.

Descriptors: *Bioaccumulation, *Arsenic, *Freshwater algae, *Inorganic arsenic, Water pollution effects, Chlorophyta, Chlorella vulgaris, Temperature, Phosphates, Light intensity, Photosynthesis.

Green algae, Chlorella vulgaris was isolated from an arsenic-polluted environment and examined for the effects of arsenic levels, arsenic valence, temperature, illumination intensity, phosphate levels, metabolism inhibitors, and heat treatment, on the growth and arsenic bioaccumulation. Conclusions reached were that:(1) cell growth increased with an increase of arsenic (V) levels of the medium up to 2,000 ppm, and the cell survived even at 10,000 ppm, and (2) arsenic bioaccumulation increased with an increase of the arsenic level. The maximim accumulation of arsenic was about 50,000 micrograms As/g dry cell. Growth decreased with increases in the arsenic (III), level and the cell was cytolyzed at levels higher than 40 ppm. No arsenic(V) was bioaccumulated by a cell which had been pretreated with dinitrophenol (respiratory inhibitor) or with heat. Little effects were observed of NaN3 (photosynthesis inhibitor) on the bioaccumulation of arsenic was observed. (Author's abstract)
W87-02907

TRANSPORT AND LOSS OF NITROUS OXIDE IN SOIL WATER AFTER FOREST CLEAR-CUTTING,
Yale Univ., New Haven, CT. School of Forestry and Environmental Studies.
W. B. Bowden, and F. H. Bormann.
Science SCIEAS, Vol. 233, No. 4766, p 867-869, August 22, 1986. 1 fig, 2 tab, 22 ref.

Descriptors: *Nitrous oxide, *Solute transport, *Fate of pollutants, *Soil water, *Clear-cutting, Nitrogen compounds, Forest management, Nitrogen cycle, Nitrates, Path of pollutants.

Various harvesting practices stimulate the loss of dissolved ionic forms of nitrogen, especially nitrates in stream water attributed to an increase in the activity of autotrophic, and possibly heterotrophic, nitrifiers. Questioned was whether the production of NO3(-) after clear-cutting also stimulated the production of gaseous nitrogen compounds by nitrification or denitrification. Water samples were collected from seeps, sampled in a whole-tree harvested watershed and in various 70-year old, second growth watersheds. Dominant trees were sugar maple, American beech, and yellow birch with stands of red spruce and balsam fir at the highest elevations. Whole-tree harvesting increased the concentration of nitrous oxide dissolved in soil water by two orders of magnitude over the concentration expected in equilibrium with the atmosphere. The nitrous oxide content of soil water in an intact second-growth forest was close to the expected theoretical value. Nitrous oxide dissolves in soil water and is transported to seeps and streams where it rapidly degasses from the solution and is released into the atmosphere. This loss of nitrous oxide is not important to the nitrogen economy of the site, but it may be important to the global atmospheric budget of nitrous oxide. (Khumbatta-PTT)
W87-02912

PLACERS OF COSMIC DUST IN THE BLUE ICE LAKES OF GREENLAND,
For primary bibliographic entry see Field 2C.
W87-02913

FLURIDONE RETENTION AND RELEASE IN SOILS,
North Carolina State Univ. at Raleigh. Dept. of Crop Science.
J. B. Weber, P. H. Shea, and S. B. Weed.
Soil Science Society of America Journal SSSJD4, Vol. 50, No. 3, p 582-588, May-June 1986. 1 fig, 7 tab, 24 ref.

Descriptors: *Fluridone, *Path of pollutants, *Soil chemistry, *Adsorption, Desorption, Organic matter, Clay minerals, Herbicide, Pesticides, Chemical reactions, Solute transport, Hydrogen ion concentration, Clay, Sands.

Aqueous adsorption/desorption studies showed that fluridone (1-methyl-3-phenyl-5(3-trifluoromenthyl) phenyl)-4-(1H)-pridinone) adsorbed to both organic matter and montmorillonite clay surfaces in 18 soils. Adsorption ranged from a high of 0.81 millimol/kg on Earle clay to a low of 0.02 millimol/kg on an Amarillo loamy sand. Fluridone adsorption was highly corellated with montmorillonite clay or organic matter contents of the soils, but the highest correlation coefficients (r=0.92) resulted when adsorption was correlated with both clay and organic matter contents. Adsorption isotherms for fluridone on three soils were of the

S-type on soils containing low amounts of organic matter and high amounts of montmorillonite clay, and of the L-type on soils high in organic matter and with low mixed clay mineralogy. Isotherms for soils low in organic matter and clay content were linear, or of the L-type. Fluridone adsorption increased by 38 to 42% when solution pH was decreased from 6.4 to 3.5, and the berdicide was not readily desorbed with water at the low pH level. Large amounts (58%) were desorbed with water where adsorption occured at higher pH levels (6.4), suggesting that only physical binding was involved. Incubation of fluridone adsorbed on soil pellets under wet, 50 degree C conditions reduced fluridone that could be displaced with water by 10 to 20%, suggesting that climatic factors may affect adsorption/desorption, mobility in soil, bioactivity, and pesistence of the herbicide. X-ray diffraction studies revealed that the herbicide was adsorbed in the interlayer surfaces of montmorillonite clay and delta spacing ranged from 0.2 to 0.4 nm. (Author's abstract)
W87-02918

EFFECT OF CATCHMENT SIZE ON PHOSPHORUS EXPORT,
McGill Univ., Montreal (Quebec). Dept. of Biology.
Y. T. Prairie, and J. Kalff.
Water Resources Bulletin WARBAQ, Vol. 22, No.3, p 465-470, June 1986. 4 fig, 4 tab, 20 ref.

Descriptors: *Nutrient modeling, *Path of pollutants, *Phosphorus export, *Catchment size, Spatial scale effects, Agricultural practice, Phosphorus removal, Catchment areas, Lakes, Model studies, Forest watersheds.

The movement of phosphorus from catchments to lakes is of particular interest to nutrient modeling of lakes. Phosphorus export, is expressed commonly on an areal basis to allow comparison of catchments of different sizes. This specifically assumes that total phosphorus export is a linear function of catchment area. The hypothesis that phosphorus export (expressed as kgP/yr) is a linear function of catchment size and whether or not this linearity, or lack thereof, is constant among catchments with different land uses was tested. The data show that in agricultural catchments, total phosphorus (TP) export varies as the 0.77 power of drainage basin area, resulting in a reduction in phosphorus delivery per unit area with increasing catchment size. Following further division of catchments according to agricultural practice, it was found that the spatial scale effect is restricted to row crops and pastures. Statistical models were developed to allow a comparison of TP export from catchments of different sizes. Such models are not needed for nonrow crops, mixed agricultural and forested catchments, where TP export is a linear function of catchment size. (Author's abstract)
W87-02941

POLLUTANTS ASSOCIATED WITH SAND AND SALT APPLIED TO ROADS IN MINNESOTA,
Metropolitan Council, St. Paul, MN.
G. L. Oberts.
Water Resources Bulletin WARBAQ, Vol. 22, No. 3 p 479-484, June 1986. 2 tab, 13 ref.

Descriptors: *Path of pollutants, *Sand, *Salt, *Highway runoff, *Minnesota, *Snowmelt, *Deicers, Nonpoint pollution sources, Water quality assessment, Urban runoff, Phosphorus, Lead, Zinc.

The component of snowmelt pollutant washoff due to sand and salt application to roadways in Minnesota is simulated. Laboratory methods are used to extract various pollutants from sand-salt mixtures commonly used in the Minneapolis-St. Paul Metropolitan Area of Minnesota for keeping winter road conditions safe. Values derived in the laboratory are compared with actual snowmelt runoff values to estimate the contribution of materials application. High concentrations of solids, phosphorus, lead and zinc in snowmelt from road surfaces are due in part to sand and salt spread to improve winter driving conditions. The source of sand and salt appears to be influential in determining the pollutant levels. Judicious use and careful application of materials can reduce the increment of pollution due to anti-akid sand and salt applied to road surfaces. The amount of salt in the mixture is positively correlated with the total Pb in the extracted sample solutes. (Author's abstract)
W87-02943

EFFECT OF WAVES ON BUOYANT JETS,
Memorial Univ. of Newfoundland, St. John's. Faculty of Engineering and Applied Science.
J. J. Sharp.
Proceedings of Institutional Civil Engineers PCIEAT, Vol. 81, Part 2, p 471-475, September 1986. 1 fig, 1 tab, 13 ref.

Descriptors: *Outfall sewers, *Path of pollutants, *Wave action, *Buoyancy, *Jets, Deep water, Shallow water, Wastewater disposal, Dispersion, Design.

One of the primary requirements for the design of an ocean outfall is to obtain a good estimate of the dilution which well be achieved before the liquid effluent reaches the surface. This has stimulated considerable research on buoyant jets because the effluent leaving a sewage outfall consists essentially of a buoyant jet of fresh water discharged into a saline evnironment. Similar considerations affect discharge of cooling water from power stations where the buoyancy is caused either by temperature alone (that is, for discharge into a lake) or by a combination of buoyancy and salinity (for example, for estuarial discharge with a longitudinal separation of intake and outfall). The effect of deep and shallow water waves on the trajectory of a submerged buoyant jet is described. The 'dumb-bell effect' which occurs when shallow water waves cause the jet to separate into two relatively distinct effluent clouds is explained. This effect is not experienced with deep water waves which cause increased dispersion in the upper part of the ring column. (Michael-PTT)
W87-02964

STUDY ON THE MODELLING OF THE BEHAVIOR OF PHOSPHORUS RELEASED FROM SEDIMENTS,
Yamaguchi Univ. (Japan). Div. of Sanitary Engineering.
For primary bibliographic entry see Field 2L.
W87-02967

MODELLING OF STRATIFIED FLOW AND EUTROPHICATION IN RESERVOIRS,
Central Research Inst. of Electric Power Industry, Tokyo (Japan). Civil Engineering Lab.
For primary bibliographic entry see Field 5C.
W87-02968

ASSESSMENT OF THE IMPACT OF EUTROPHICATION CONTROL MEASURES ON SOUTH AFRICAN IMPOUNDMENTS,
Orange Free State Univ., Bloemfontein (South Africa). Inst. of Environmental Sciences.
For primary bibliographic entry see Field 5G.
W87-02973

BASIN-WIDE ECOLOGICAL FATE MODEL FOR MANAGEMENT OF CHEMICALS HAZARD,
Osaka Univ. (Japan). Dept. of Environmental Engineering.
T. Morioka, and S. Chikami.
Ecological Modelling, ECMODT Vol. 31, No. 1-4, p 267-281, May 1986. 7 fig, 10 tab, 7 ref.

Descriptors: *Catchment areas, *Chemical wastes, *Runoff, *Path of pollutants, *Ecological models, *Pollution transport, *Tokyo Bay, *Osaka Bay, Japan, Linear alkylbenzenesulfonate, Tributylphosphate, Hexachlorobenzene, Dioctylphthalate, Hexachlorocyciohexane, Mathematical models, Soil pollution, Yodo River basin, Herbicides, Field tests.

A basin-wide ecological model is proposed for signifying the relationship between amounts of discharged chemicals and chemical concentrations in the aquatic environment. The proposed multicompartment model describes transport of chemicals (linearalkylbenzenesulfonate, LAS; tributylphosphate, TBP; hexachlorobenzene, HCB; dioctylphthalate, DOP; and hexachlorocyclohexane, BHC) in the receiving water, sorption by suspended solids and plankton, and degradation in the environment. The loadings of LAS, TBP, and HCB to Tokyo Bay (Japan) and DOP and BHC to Osaka Bay were estimated by operating the model accompanied by a tidal mixing submodel. The loadings of these chemicals estimated by simulation achieved values in the reasonable range of input amounts obtained by using another aggregation technique in the river sections. In the serial subbasin fate model, environmental behavior of BHC isomer is influenced by both the magnitude of the direct loading to the aquatic environment (derived from the fugacity equilibrium model simulation for the post-consumption process of chemicals) and the first-order runoff coefficient with respect to the accumulated BHC in the soil. Calculated BHC concentrations in the Yodo River basin show a declining tendency to one observed in a field survey conducted after a ban on BHC-containing herbicide. (Author's abstract)
W87-02975

MODELLING OF INDUSTRIAL ECOLOGICAL SYSTEMS FOR EVALUATION OF HEALTH SERVICES,
University of Occupational and Environmental Health, Kitakyushu (Japan). School of Medicine.
For primary bibliographic entry see Field 4C.
W87-02979

UNDER EPA SCRUTINY: UNDERGROUND STORAGE TANKS,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
K. W. Brown.
Grounds Maintenance, Vol. 21, No. 7, p 56+, July 1986.

Descriptors: *Underground storage, *Leakage, *Cleanup, *Cost analysis, *Petroleum products, *Water pollution sources, Storage tanks, Regulations, Detection, Testing procedures, Plumbing.

There are presently more than two million underground storage tanks in the United States, with an average useful life of about 15 years. Some officials estimate that as many as 70,000 underground storage tanks already are leaking, and 350,000 tanks could be leaking within 5 years. All metal tanks eventually will corrode in the soil. The corrosion rate depends on the: (1) Completeness of the coating, (2) Mineralogy of the soil, (3) Soil moisture, pH and salinity condition, (4) Presence of other metals in the soil, and (5) Condition of the cathodic protection system, if one was installed. Studies indicate that concentrated organic solvents and petroleum products can cause clays to shrink and crack, thus allowing the chemicals to move through these soils 100 to 1,000 times faster than water moves. There has been some success with introducing nutrients and sources of oxygen into contaminated aquifers to stimulate microbial degradation of dissolved hydrocarbons. The technology of leak detection is improving rapidly, and it is likely that the regulations being developed will require improved inventory records, periodic tank testing and monitoring systems in the soil to demonstrate that a tank is not leaking. All new underground tanks for petroleum products or hazardous substances will need to be constructed of noncorrosive material, or they must be designed to prevent release of stored substances. New codes and regulations will be developed for future installation of tanks and plumbing systems. Although these programs will increase installation and management costs, the net result will minimize the probability of future cleanup and thus, save money in the long run. (Alexander-PTT)
W87-03021

REVIEW OF THE ROLE OF BED DEPOSITS IN THE PHOSPHATE EUTROPHICATION OF LAKES AND RIVERS,
Mid-Kent Coll. of Higher and Further Education, Chatham (England).
M. A. Malati, and I. Fox.
International Journal of Environmental Studies IJEVAW, Vol. 26, No. 1/2, p 43-54, 1985. 2 fig, 69 ref. Department of the Environment (England) Contract PECD 7/7/039.

Descriptors: *Lakes, *Rivers, *Eutrophication, *Phosphorus cycles, *Phosphates, *Sediment-water interface, *Mathematical models, Clays, Phosphorus, Aluminum, Iron, Oxidation, Soil chemistry, Minerals.

The distribution of phosphates in fresh waters and the P cycles are discussed and the chemistry of P in lakes is reviewed, with special reference to the extraction methods for the fractionation of P in soils and sediments. Models of the sediment-water exchange are also discussed together with their environmental implications. Adsorption by and desorption from sediments, especially clays, are reviewed with reference to the adsorption mechanism on clays and the oxides of Fe and Al. Desorption of phosphate from the relevant minerals and soils is discussed in relation to the effects of sediment and water parameters affecting release of phosphate from sediments. (Author's abstract)
W87-03022

INSECTICIDES AND METALS IN NIGERIAN SURFACE WATER - WARRI RIVER,
Benin Univ., Benin City (Nigeria). Dept. of Chemistry.
S. S. Atuma, and A. B. M. Egborge.
International Journal of Environmental Studies IJEVAW, Vol. 27, No. 1/2, p 139-142, 1986. 2 tab, 10 ref.

Descriptors: *Organochlorine pesticides, *Trace metals, *Insecticides, *Residual levels, *Warri River, Nigeria, Lindane, DDT-complex, Heptachlor epoxide, Cadmium, Copper, Zinc, Manganese, Lead, Arsenic, Atomic absorption spectrophotometry, Africa.

The occurrence of organochlorine pesticide residues and trace metals is reported in samples taken at various points along the Warri River, Nigeria. Analysis of 21 water samples revealed concentrations of the quantifiable organochlorine compounds detected (lindane, DDT-complex, and heptachlor epoxide) between 0.001 and 0.014 nanogram (ng)/ml. In pooled catfish samples concentrations ranged from 0.70 to 1.5 ng/g fresh weight. Analysis of metals (Cd, Cu, Zn, Mn, Pb, and As) by atomic absorption spectrophotometry showed levels comparable with those obtained in other parts of Africa. (Rochester-PTT)
W87-03028

FERTILIZERS SUITABLE FOR THE ENVIRONMENT AS PART OF A REORIENTATION IN AGRICULTURAL POLICY,
Federal Association of the German Gas and Water Industry, Bonn (Germany, F.R.).
For primary bibliographic entry see Field 5G.
W87-03040

PETROLEUM RECOVERY OPERATIONS IN AN URBAN AREA,
New York State Dept. of Transportation, Hauppauge.
For primary bibliographic entry see Field 5G.
W87-03065

DRINKING-WATER CONTRIBUTION TO NATURAL BACKGROUND RADIATION,
Environmental Protection Agency, Washington, DC. Office of Drinking Water.
For primary bibliographic entry see Field 5F.
W87-03084

RADIONUCLIDE CONCENTRATIONS IN LOUISIANA SOILS AND SEDIMENTS,
Louisiana State Univ., Baton Rouge. Lab. for Weland Soils and Sediments.
R. D. DeLaune, G. L. Jones, and C. J. Smith.
Health Physics HLTPAO, Vol. 51, No. 2, p 239-244, August 1986. 3 fig, 2 tab, 14 ref.

Descriptors: *Radionuclides, *Louisiana, *Soil analysis, *River sediments, Mississippi River, Urban areas, Industrialization, Silts, Clays, Cesium-137, Potassium-40, Uranium, Thorium, Radium-226, Thorium-232, Radium radioisotopes, Radioisotope decay series., Baseline series.

Thirty-seven soil samples representing the major soil types of Louisiana were collected from various sites in order to establish the baseline concentrations of radionuclides in Louisiana soils and sediment. Sampling was concentrated in heavily industrialized and urban areas along the Mississippi River from Baton Rouge to New Orleans. The soil or sediment samples were collected from the surface horizon (15 cm); all were finely-grained, predominantly silts and clays, with no coarse fractions. Gamma spectrum was determined with a Ge(Li) detector connected to a multichannel analyzer. Except for two isotopes, the gammas detected came from the U and Th decay series; the two isotopes not associated with this series were Cs-137 and K-40. Three major natural gamma radiation sources were identified: Ra-226, Th-232, and K-40. (Rochester-PTT)
W87-03085

FIELD VALIDATION OF THE CONTAMINANT TRANSPORT MODEL, FEMA,
Miami Univ., Coral Gables, FL. Coll. of Engineering.
K. F. V. Wong, and G. T. Yeh.
Applied Mathematical Modelling AMMODL, Vol. 10, No. 3, p 155-161, June 1986. 7 fig, 10 ref. DOE Contract DE-AC05-840R21400.

Descriptors: *Path of pollutants, *Field tests, *Groundwater pollution, *Waste chloride, *Nitrogen compounds, *FEMA models, *Contaminant transport models, *Groundwater contamination, Mathematical models, Idaho, Landfills, Miami, Florida, Prediction.

Validation with field data is described for a finite element model of material transport through aquifers (FEMA). The approach used assumes that the transport in the aquifer is primarily horizontal everywhere and that the vertical component of the flux may be neglected; the error introduced by this assumption is small in most cases of practical interest. Field data from the Idaho Chemical Processing Plant, southeastern Idaho, and the 58th Street Landfill, Miami, Florida, were used. In both cases the model was first calibrated and then integrated over a span of 8 yr to check on its predictive capability. Waste chloride and total organic nitrogen were the contaminants of interest. Both predictive runs gave results that matched well with available data. (Rochester-PTT)
W87-03089

ORGANIC WATER: ISOTOPIC CHARACTERIZATION AND EVIDENCE FOR ITS ROLE IN THE FEDJ-EL-ADOUM PB-ZN DEPOSIT, TUNISIA (EAU ORGANIQUE: CARACTERISATION ISOTOPIQUE ET EVIDENCE DE SON ROLE DANS LE GISEMENT PB-ZN DE FEDJ-EL-ADOUM, TUNISIE),
S. M. F. Sheppard, and A. Charef.
Comptes Rendus de l'Academie des Sciences (Series 2) CHDDAQ, Vol. 302, No. 19, p 1189-1192, May 21, 1986. 2 fig, 18 ref.

Descriptors: *Organic water, *Fedj-el-Adoum deposit, *Hydrogen isotopes, Lead, Zinc, Tunisia, Bitumen, Coal, Kerogen, Petroleum, Organic gases, Isotope studies, Mineralization, Deuterium, Sulfate reduction, Bacterial physiology, Metamorphic water, Isotope ratios, Transformation.

Organic water is defined to be a water with D/H ratio derived from the direct or indirect transformation — dehydration, dehydrogenation, oxidation or exchange — of organic matter, bitumen, coal, kerogen, petroleum, organic gases, etc. The hydrogen isotope compositions, deltaD, are estimated to be in the range -9 to 25 % with O-18/O-16 ratios similar to formation or metamorphic waters. Based on D/H, C-13/C-12, and S-34/S-32 and fluid inclusion data, fluids responsible for massive Pb mineralization at Fedj-el-Adoum are interpreted to be organic waters derived from the oxidation of organic material during bacterial sulfate reduction processes at about 70 C. (Author's abstract)
W87-03090

LIQUID CHROMATOGRAPHIC DETERMINATION OF FLURIDONE AQUATIC HERBICIDE AND ITS METABOLITE IN FISH AND CRAYFISH,
Lilly (Eli) and Co., Indianapolis, IN. Lilly Research Lab.
For primary bibliographic entry see Field 5A.
W87-03113

MONITORING POLLUTION,
For primary bibliographic entry see Field 5A.
W87-03117

IMPACTS FROM MOSQUITO CONTROL-INDUCED SULPHUR MOBILIZATION IN A CAPE COD ESTUARY,
National Park Service, Boston, MA. Office of Scientific Studies.
For primary bibliographic entry see Field 5C.
W87-03127

SOURCES OF NITRATE TO GROUND WATER,
Wisconsin Univ.-Madison. Dept. of Soil Science.
D. Keeney.
CRC Critical Reviews in Environmental Control CCECAU, Vol. 16, No. 3, p 257-304. 1 fig, 4 tab, 341 ref.

Descriptors: *Nitrates, *Groundwater pollution, *Contamination, Soil water, Soil chemistry, Leaching, Mineralization, Nitrogen, Nitrification, Nitrogen cycle, Denitrification, Aeration zone, Lysimeters, Measuring instruments, Sampling, Forest soils, Grasslands, Fertilization, Irrigation practices, Manure, Sludge utilization, Watersheds, Aquifers, Computer models, Monitoring, Reviews.

The sources of nitrate contamination of groundwater resources were reviewed. The primary internal soil reactions that influence the amount of nitrate available for leaching below the root zone were examined in relation to mineralization-immobilization, nitrification, denitrification and plant uptake and nitrate recycling. The influence of spatial variability and nitrate movement through soils on nitrate leaching in the unsaturated zone was described. Methods for measuring nitrate flux such as lysimetry, porous cup soil solution sampling, nitrate extraction from soil core samples and subsoil installation of ceramic vacuum plates were evaluated. Nitrate leaching output data from field studies of both unmanaged ecosystems and managed forests and grasslands were presented and the effect of fertilization and irrigation practices on nitrate levels in surface and groundwater of agricultural lands was described. Problems associated with quantifying nitrogen mineralization rates to calculate load rates for sludge and manure applications are discussed. The use of nitrogen ratios to identify nitrate sources was reviewed. Regional monitoring studies that incorporate watershed, aquifer and ecosystem factors were discussed in terms of nitrate sources and requirements for designing and interpreting data from watershed-level source identification studies. Computerized simulation models of the nitrogen cycle and nitrate emission levels were described and the best management practices to minimize nitrate leaching are also presented. (Michael-PTT)
W87-03130

ARSENIC DISTRIBUTIONS IN POREWATERS AND SEDIMENTS OF PUGET SOUND, LAKE WASHINGTON, THE WASHINGTON COAST AND SAANICH INLET, B.C.,
Washington Univ., Seattle. School of Oceanogra-

phy.
M. L. Peterson, and R. Carpenter.
Geochimica et Cosmochimica Acta GCACAK, Vol. 50, No. 3, p 353-369, March 1986. 7 fig, 7 tab, 47 ref. DOE Contract DE-AT06-76-EV-70024.

Descriptors: *Arsenic, *Interstitial water, *Lake sediments, *Marine sediments, *Washington State, *British Columbia, Aluminum, Manganese, Oxidation, Lead radioisotopes, Deposition, Adsorption, Iron, Hydrogen sulfide, Ions.

Arsenic distribution in porewater and sediments from Puget Sound, Lake Washington, the Washington State coast and Sannich Inlet, B.C. was studied to determine vertical distribution of both solid and dissolved As phases in recent sediments. Detailed profiles of solid phase As, Al, Mn, and excess Pb210 were developed to provide a basis for interpreting As distributions in relation to the processes responsible for and rates of As deposition. Dissolved As, Mn(2+), Fe(2+) and H2S and solid phase As, Mn and excess Pb210 profiles suggest that adsorption onto hydrous Mn and Fe oxides, solid phase As concentrations, bioturbation, pH and solid phase incorporation all play significant roles in determining porewater As concentrations and the partitioning of dissolved As between oxidized and reduced species. (Michael-PTT)
W87-03133

STUDY OF FOAMY THERMOMINERAL WATER OF FRENCH MASSIF CENTRAL. I. OXIDATION-REDUCTION POTENTIAL AND BEHAVIOR OF IRON (ETUDE DES EAUX THERMOMINEARALES CARBOGAZEUSES DU MASSIF CENTRAL FRANCAIS. I. POTENTIEL D'OXYDO-REDUCTION ET COMPORTEMENT DU FER),
Bureau de Recherches Geologiques et Minieres, Orleans (France). Inst. Mixte de Recherches Geothermiques.
A. Criaud, and C. Fouillac.
Geochimica et Cosmochimica Acta GCACAK, Vol. 50, No. 4, p 525-533, April 1986. 4 fig, 4 tab, 27 ref.

Descriptors: *Thermo mineral water, *Spring water, *Geochemistry, *Iron, *France, Thermodynamics, Solubility, Siderite, Oxidation, Electrochemistry, Ferric hydroxide, Equilibrium, Dissolved oxygen.

The geochemistry of iron in thermomineral waters from France's Massif Central was studied as it relates to the redox potential of this type of water. Thermodynamic calculations were performed and the distribution of iron was found to be controlled by the solubility of siderite. Oxidation potential measured by calomel and platinum electrodes corresponded to an electrochemical equilibrium which involved ferric hydroxide or oxyhydroxide. Values measured in the field agreed with those predicted from the equilibrium between siderite and amorphous Fe(OH)3, the association of which acted as a redox buffer. Dissolved oxygen was not in equilibrium with the ferrous-ferric couple and did not affect the measured potential. Even when of local theoretical significance as a thermodynamic variable, this redox potential represents only partial equilibrium conditions. (See also W87-03146) (Author's abstract)
W87-03134

GEOCHEMICAL AND ENVIRONMENTAL PROCESSES AFFECTING RADIONUCLIDE MIGRATION FROM A FORMERLY USED SEEPAGE TRENCH,
Oak Ridge National Lab., TN. Environmental Sciences Div.
For primary bibliographic entry see Field 5E.
W87-03135

BIOGENIC METHANE FORMATION IN MARINE AND FRESHWATER ENVIRONMENTS: CO2 REDUCTION VS. ACETATE FERMENTATION-ISOTOPE EVIDENCE,
Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hanover (Germany, F.R.).
M. J. Whiticar, E. Faber, and M. Schoell.
Geochimica et Cosmochimica Acta GCACAK, Vol. 50, No. 5, p 693-709, May 1986. 12 fig, 1 tab, 121 ref. BMFT Grant 03E 6237 A.

Descriptors: *Methane, *Marine environment, *Carbon dioxide, *Acetates, *Fermentation, *Isotope studies, Carbon isotopes, Hydrogen isotopes, Methanogenesis, Marine sediments, Deuterium, Hydrogen.

Primary methanogenic pathways in freshwater and marine environments can be characterized by combining stable carbon and hydrogen isotope data of methane with data from coexisting dissolved CO2 and formation water. In marine sediments, methane formed by CO2 reduction is more often depleted in 13C and has greater carbon isotope separation than methanogenesis by acetate fermentation in freshwater. Methane formed by transfer of a methyl group is more depleted in deuterium than that formed by CO2 reduction. In this case, hydrogen is incorporated directly from the formation water with a constant fractionation. During acetate fermentation, only one quarter of the hydrogen is derived from formation water, probably as a result of an intermediate H2O-H2 dissociation step. Biogenic methane formed by either CO2 reduction or acetate fermentation pathways can be present in both freshwater and marine environments. The predominance of the fermentation pathway in freshwater sediments is due to the availability of methyl from precursors such as acetate. In marine sediments, methanogenesis is limited to those with dissolved sulfate due to competition for hydrogen and acetate-type precursors. (Michael-PTT)
W87-03137

EARLY DIAGENESIS OF CADMIUM AND COBALT IN SEDIMENTS OF THE LAURENTIAN TROUGH,
Quebec Univ., Rimouski. Dept. of Oceanography.
A. Gendron, N. Silverberg, B. Sundby, and J. Lebel.
Geochimica et Cosmochimica Acta GCACAK, Vol. 50, No. 5, p 741-747, May 1986. 4 fig, 4 tab, 35 ref.

Descriptors: *Diagenesis, *Fate of pollutants, *Cadmium, *Cobalt, *Laurentian Trough, *Marine sediments, Manganese hydroxide, Ferric hydroxide, Oxidation, Particulate matter, Organic matter, Estuaries, Plankton, Chemical analysis.

Measurements of cobalt and cadmium in Laurentian Trough sediments were performed to demonstrate that these elements exhibit strongly contrasting behaviors during early diagenesis that are consistent with their expective particle associations and chemistry. A mobile component of cobalt is associated with manganese and ferric hydroxides and follows a redox sensitive pattern of dissolution in the reducing zone of the sediment, vertical migration, enrichment by precipitation in the oxidized surface layer and redistribution along the bottom in particulate form. Particulate cadmium arrives at the sediment surface bound to biogenic material, is rapidly solubilized during aerobic degradation of organic matter and migrates vertically both into the reducing zone where it precipitates and back into the water column where it may be recylced through biological processes. In an estuary, cobalt will be concentrated in the oxidized sediment layer and tend to migrate landward, while cadmium will be most abundant in sediments underlying those regions of high plankton production relative to dilution by terrigenous particles. (Michael-PTT)
W87-03138

CHEMICAL CONTROL OF SOLUBLE PHOSPHORUS IN THE AMAZON ESTUARY,
Harvard Univ., Cambridge, MA. Center for Earth and Planetary Physics.
L. E. Fox, S. L. Sager, and S. C. Wofsy.
Geochimica et Cosmochimica Acta GCACAK, Vol. 50, No. 5, p 783-794, May 1986. 17 fig, 3 tab, 37 ref. NASA Grant NAG-1-55, NSF grant DEB-79-20282, EPA Grants R810219-01-0, CR807809.

Descriptors: *Phosphorus, *Chemical analysis, *Dispersion models, *Solubility, *Amazon River, Estuaries, Sediments, Salinity, Iron, Humic acids, Suspended sediments, Fluctuations, Model studies, Distribution, Concentration.

Phosphorus chemistry of the Amazon River estuary was determined using field data and data derived from a dispersion model which reproduced the main features of observed salinity and phosphorus distributions. Bottom sediments released soluble inorganic phosphorus when suspended in mixtures of seawater and deionized water. Release rates depended on salinity, but not on sediment concentrations. Phosphate inputs persisted for three days at a lower concentration of sediment suspension, but increased to more than eight days at a higher concentration. The dispersion model predicted phosphate concentrations that were consistent with observations and provided quantitative estimates of total fluxes of soluble inorganic phosphorus to the high salinity fringes of the estuary. More than half of this phosphorus appears to originate from reactions of suspended sediments in the estuary. The low salinity removal is probably associated with reactions that remove iron and humic substances in the same salinity range. (Michael-PTT)
W87-03139

GEOCHEMISTRY OF TIN IN RIVERS AND ESTUARIES,
Florida State Univ., Tallahassee. Dept. of Oceanography.
J. T. Byrd, and M. O. Andreae.
Geochimica et Cosmochimica Acta GCACAK, Vol. 50, No. 5, p 835-845, May 1986. 9 fig, 6 tab, 32 ref. NSF grants OCE-7920183, OCE-8200931.

Descriptors: *Geochemistry, *Fate of pollutants, *Tin, *Rivers, *Estuaries, Estimating, Metal-finishing wastes, Pollution load, Sediments, Diagenesis, Particulates, Leaching.

Riverine fluxes of tin to oceans were estimated based on a large number of estuaries that ranged from pristine to highly polluted. Rivers were sampled and analyzed for both dissolved and acid-leachable particulate tin. Total digests of selected particulate samples were analyzed to determine the amount of tin locked within particles and not released by acid leaching. Rivers appear to supply very little tin to the surface ocean in forms available for geochemical reactions. Riverine flux of dissolved, available tin is substantially smaller than atmospheric continent-to-ocean flux of tin. Tin may be mobilized during sediment diagensis in some estuaries such as those that may be polluted by metallic wastes or paint additives, but this does not appear to be widespread or important. Most of the tin that is weathered from the continents reaches the ocean locked in particulates which deposit on continental margins and are removed from further consideration in the geochemical tin cycle. (Michael-PTT)
W87-03140

EFFECT OF OXYGEN ON RELEASE AND UPTAKE OF COBALT, MANGANESE, IRON AND PHOSPHATE AT THE SEDIMENT-WATER INTERFACE,
Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Analytical and Marine Chemistry.
B. Sundby, L. G. Anderson, P. O. J. Hall, A. Iverfeldt, and M. M. Rutgers van der Loeff.
Geochimica et Cosmochimica Acta GCACAK, Vol. 50, No. 6, p 1281-1288, June 1986. 6 fig, 1 tab, 36 ref.

Descriptors: *Oxygen, *Cobalt, *Water pollution sources, *Manganese, *Iron, *Phosphates, *Sediment-water interfaces, Measuring instruments, Benthic environment, Kinetics, Radioactive tracers, Fluctuations, Ions, Heavy metals, Sweden.

An in situ flux chamber experiment was conducted near Gullmarsfjorden, Sweden to measure fluxes of redox sensitive species of Mn, Fe, Co and PO4 under conditions where dissolved oxygen and pH in the enclosed water were maintained close to ambient values and where they were allowed to

fluctuate due to benthic respiration. An accidental interruption of stirring in the regulated chamber caused a pulse of dissolved Co, Mn, Fe and PO4 to be released from the sediment, but when stirring was resumed, all four ions were again removed. Removal kinetics were similar to those of radioactive tracers 59Fe and 54Mn from water in the unregulated chamber. Oxygen flux is the critical variable which controls reactions at the sediment-water interface. When measuring fluxes of substances which may dissolve or precipitate depending on redox conditions, it is important that the oxygen flux from the water column to the sediment be maintained as closely as possible to natural conditions. If not, observed fluxes may be unrealistic and reflect variations in the oxygen supply to the sediment rather than in situ processes. (See also W87-03144) (Michael-PTT)
W87-03143

BENTHIC FLUXES OF CADMIUM, COPPER, NICKEL, ZINC AND LEAD IN THE COASTAL ENVIRONMENT,
Chalmers Univ. of Technology, Goeteborg (Sweden). Dept. of Analytical and Marine Chemistry.
S. F. G. Westerlund, L. G. Anderson, P. O. J. Hall, A. Iverfeldt, and M. M. Rutgers van der Loeff.
Geochimica et Cosmochimica Acta GCACAK, Vol. 50, No. 6, p 1289-1296, June 1986. 7 fig, 5 tab, 26 ref.

Descriptors: *Benthic environment, *Water pollution sources, *Fluctuations, *Cadmium, *Copper, *Nickel, *Zinc, *Lead, *Coastal waters, Trace metals, Interstitial water, Oxygen, Solubility, Sediment-water interfaces, Heavy metals, Seawater.

In situ measurements of cadmium, copper, nickel, zinc and lead fluxes across the seidment-water interface were performed using benthic flux chambers equipped so that dissolved oxygen and pH could be maintained at near ambient values or allowed to change in response to benthic respiration. Trace metals were released at constant rates in the regulated chamber during fall and winter experiments, but in winter, release rates were lower for Cu and Ni. Neither release nor sediment uptake could be demonstrated for Pb. Collected pore water was depleted in Cd, Cu and Zn and slightly enriched in Ni and Pb relative to ambient seawater. There was no correlation between fluxes calculated from pore water profiles and those acutally measured, nor could fluxes be directly related to organic matter degradation rates. Trace metal release rates were lower in the unregulated chamber. Metal flux decrease rates decreased as oxygen decreased and were ultimately reversed as sulfide appeared in the water. Fluxes measured with benthic chambers are sensitive to the oxygen regime and to hydrodynamic conditions within the chambers. Oxygen flux across the sediment-water interface depends on the oxygen concentration at the top of the diffusive boundary layer that separates the sediment from the well mixed water in the chamber and on the thickness of the boundary layer. (See also W87-03143) (Michael-PTT)
W87-03144

NONPOINT SOURCE LOADING OF PHENOLIC ACIDS FROM DECOMPOSING CROP RESIDUE,
Maryland Univ., College Park. Dept. of Agronomy.
S. Glenn, and G. H. Williams.
Soil and Tillage Research SOTRD5, Vol. 6, No. 1, p 45-51, September 1985. 1 tab, 17 ref.

Descriptors: *Corn, *Water pollution sources, *Barley, *No-tillage management, *Conventional tillage management, *Nonpoint pollution sources, *Phenolic acids, *Runoff, Maryland, Turnips, Toxicity, Bioassay, Plant pathology, Integrated water samples, Radicle growth inhibition.

Two adjacent but separate watersheds in Howard County, Maryland, were equipped to quantify the total volume of runoff water and to collect an integrated water sample. One watershed was planted with corn (Zea mays L.) using no-tillage (NT) management and barley (Hordeum vulgare L.) as a cover crop or left in corn stubble. The other watershed was planted with corn using conventional tillage (CT) management. Runoff water was sampled between 1983 and analyzed for total phenolic acids and phytotoxicity to turnip (Brassica rapa L.). The volume of runoff water was reduced under NT management, but the concentration and total loading of phenolic acids were greater in runoff water from the NT watershed compared to that found in runoff water from the CT watershed. There was no clear relationship between phenolic acid concentration in runoff and turnip radicle length; however, the runoff sample with the greatest concentration of phenolic acids (18 June 1979; 65 ppm phenolic acids) caused the greatest inhibition of turnip radicle growth. (Author's abstract)
W87-03161

DETERMINISTIC AND STOCHASTIC ANALYSES OF DISPERSION IN AN UNBOUNDED STRATIFIED POROUS MEDIUM,
Auburn Univ., AL. Dept. of Civil Engineering.
O. Guven, and F. J. Molz.
Water Resources Research WRERAQ, Vol. 22, No. 11, p 1565-1574, October 1986. 6 fig, 16 ref, append. US Geological Survey Project No. WRRI-G-1001-06CE, and EPA Contract No. CR 810704-03.

Descriptors: *Stochastic process, *Dispersion, *Solute transport, *Porous media, *Path of pollutants, Flow profile, Stochastic hydrology, Advection.

The dispersion of a conservative solute released instantaneously from a finite or point source in an unbounded, nonrandom periodically stratified porous medium is examined theoretically by applying the moment methods. The governing moment equations are derived for a general stratified medium and then applied to study the detailed time-dependent variations of various low-order spatial moments of the three-dimensional concentration distribution in a particular periodic (sinusoidal) stratified medium, both for the general case when the mean flow direction is inclined to the stratification, as well as for the special case of flow parallel to the stratification. The present results confirm previous results regarding the asymptotic large-time, large-scale dispersion coefficients for such a periodic medium. These results, which are obtained through a deterministic analysis, are compared also with those obtained by using previous stochastic theories. The comparison reveals several similarities, as well as some important differences between the results of the deterministic and stochastic analyses, such as the important role of nonuniform advection in the dispersion process both in the asymptotic transient period, as well as the asymptotic final period. (Author's abstract)
W87-03196

UPSTREAM WEIGHT MULTIPLE-CELL BALANCE FINITE-ELEMENT METHOD FOR SOLVING THREE-DIMENSIONAL CONVECTION-DISPERSION EQUATIONS,
California Univ., Los Angeles. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2F.
W87-03197

NEW FORMULA FOR THE ANALYTICAL SOLUTION OF THE RADIAL DISPERSION PROBLEM,
Geological Survey, Menlo Park, CA. Water Resources Div.
For primary bibliographic entry see Field 2F.
W87-03199

MODEL OF NITROGEN RELEASE FROM BOTTOM SEDIMENTS,
National Inst. for Environmental Studies, Tsukuba (Japan). Lab. of Freshwater Environment.
M. Hosomi, M. Okada, and R. Sudo.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 30-62, 15 fig, 6 tab, 38 ref.

Descriptors: *Nitrogen, *Bottom sediments, *Model studies, *Path of pollutants, Lake Kasumigaura, Lakes, Vertical distribution, Ammonia, Sensitivity analysis, Eutrophication.

A multi-component dynamic model for nitrogen in the bottom sediment-water system of Lake Kasumigaura, a highly eutrophic and shallow lake, was developed to obtain quantitative information on the sediment-water interactions. The model was calibrated and the sensitivity analysis of the model parameters conducted to identify the deficiency of our knowledge at present and to determine future research needs. Good agreement between the model calculations and observed data of nitrogen release flux and nitrogen concentrations in the sediment was noted. The nitrogen dynamics of the upper layers (0-6 cm) of the sediment seem to regulate the nitrogen transportation between sediment and water. Further studies on the vertical distribution of ammonification rate were found to be necessary from the sensitivity analysis. The effectiveness of eutrophication control programs was evaluated using the calibrated model. The reduction of nitrogen deposition rate to the sediment and the bottom sealing were more effective than sediment dredging for the control of NH4-N release from bottom sediment. (See also W87-03248) (Author's abstract)
W87-03250

STUDY ON CHEMICAL BEHAVIOR BETWEEN SEDIMENT AND UPPER WATER,
Yamaguchi Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2J.
W87-03251

EVALUATION OF THE FACTORS GOVERNING THE MOBILITY OF DREDGED MATERIAL PLACED AT OPEN WATER DISPOSAL SITES,
Connecticut Univ., Groton. Marine Sciences Inst.
For primary bibliographic entry see Field 5E.
W87-03252

NUMERICAL PREDICTION ON THE EFFECT OF PHOSPHORUS RELEASE CONTROL BY SEDIMENT DREDGING,
Port and Harbour Research Inst., Tokyo (Japan).
T. Horie.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 101-126, 27 fig, 1 tab, 6 ref.

Descriptors: *Mathematical models, *Sediments, *Phosphorus, *Dredging, *Path of pollutants, Oxygen, Phosphates, Model studies, Vertical distribution, Sediment contamination, Fate of pollutants.

A numerical model was developed to predict the behavior of phosphorus in sediment. For verification of the model, O-P, I-P in sediment, interstitial PO4-P, and PO4-P release rates were simulated from the data of the past 100 years. Furthermore, the release cutoff effect and its durability due to dredging were investigated by this model. These results are summarized as follows: (1) The model's variation of PO4-P release rate and integrated release rate, over the year, are closely correlated with the observed values; (2) The vertical distribution of T-P, O-P, and I-P in sediment closely matched the upper layer, but the lower layer was underestimated because of the effect of initial condition, iteration time, etc. Interstitial PO4-P was overestimated to the upper layer; and (3) Release cutoff was very effective just after dredging, but reduced with time. Further investigation is necessary to obtain a satisfactory solution. (See also W87-03248) (Lantz-PTT)
W87-03253

ECOLOGICAL EVALUATION OF ORGANOTIN-CONTAMINATED SEDIMENT,
Naval Ocean Systems Center, San Diego, CA. Environmental Sciences Div.
M. H. Salazar, and S. M. Salazar.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 127-149, 1 fig, 6 tab, 33 ref.

Descriptors: *Ecological effects, *Path of pollutants, *Fate of pollutants, *Sediment contamination, *Organotins, Bioassays, Toxicity, Flatfish, Mysids, Copepods, Cadmium, Chromium, Copper, Mercury, Silver, Pesticides, Polychlorinated biphenyls, Hydrocarbons, Chemical analysis.

A standard dredged material bioassay was conducted on sediment with high levels of organotins to (1) assess the toxicity and bioavailability of organotins associated with sediment, and (2) determine if this sediment would qualify for ocean disposal. Particulate-phase tests were conducted with Acanthomysis sculpta (mysid), Citharichthys stigmaeus (flatfish), and Acartia tonsa (copepod). Solid-phase tests were conducted with A. sculpta, Macoma nasuta (clam), and Neanthes arenaceodentata (polychaete worm). The bioassay also included an estimate of the potential for bioaccumulation of cadmium, chromium, copper, mercury, silver, pesticides, PCBs, petroleum hydrocarbons, and organotins. The concentration of tributyltin-oxide (TBTO) in sediment collected from Commercial Basin, San Diego Bay, California, was measured to be 780 ppb. Initial concentrations of TBTO in particulate phase test water was 0.49 ppb, and in solid phase test water 0.20 ppb. Butyltins measured in test water and test sediments demonstrate that monobutyl-, dibutyl-, and tributyltin were all leached off Commercial Basin sediments. Treatment clams accumulated organotins to a concentration on an order of magnitude above control clams (2.82 ppm TBTO vs. 0.26 TBTO), and a factor of four above treatment sediments. Survival was high in all particulate phase and solid phase tests. There were no statistically significant differences in survival when controls were compared to treatments. As demonstrated for other contaminants in other studies, high levels of organotins in sediments do not a priori indicate a significant adverse impact on the marine environment after ocean disposal. The sediment tested would qualify for ocean disposal under the present guidelines administered by EPA and the Army Corps of Engineers. (See also W87-03248) (Author's abstract)
W87-03254

CHARACTERIZATION OF SEDIMENT CONTAMINATION UTILIZING BIOASSAY/BIACCUMULATION TESTING,
Corps of Engineers, New York. New York District.
J. M. Manaky.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 150-161, 3 fig, 10 tab, 7 ref.

Descriptors: *Sediment contamination, *Bioassay, *Bioaccumulation, *Fate of pollutants, *New York Harbor, Dredging, Water pollution effects, Palaemonetes, Mercenaria, Nereis, DDT, Cadmium, Mercury, Polychlorinated biphenyls, Hydrocarbons.

A statistical analysis of 150 three-phase bioassay/bioaccumulation tests conducted on sediment from New York Harbor, indicated that only a few dredging projects consisted of sediment of ecological concern if disposed in ocean waters. Liquid and suspended particulate phase bioassays showed that for the dredged material analyzed, disposal would result in an insignificant impact to the water column. Solid phase bioassays showed that less than 4% of the dredging projects indicated environmentally significant mortality potential to benthic life. Bioaccumulation of statistically significant levels of petroleum hydrocarbons (PHC) was found to be common for all three species (Palaemonetes, Mercenaria, Nereis). Polychlorinated biphenyls (PCB) bioaccumulation was most common in the marine worm (Nereis virens). All three species exhibited a very low bioaccumulation potential for DDT, cadmium, and mercury. Some prediction was found to be possible for finding PHC or PCB bioaccumulation in two species for the same sediment. In the comparison of finding two of the analyzed contaminants in the same species for the same sediment, only PHC compared to PCB bioaccumulation showed any prediction possibility. (See also W87-03248) (Lantz-PTT)
W87-03255

INFLUENCE OF ACCUMULATING ORGANIC SEDIMENT ON THE MARINE ENVIRONMENT IN OSAKA BAY,
Ministry of Transport, Kobe (Japan). 3rd District Port Construction Bureau.
For primary bibliographic entry see Field 5C.
W87-03257

RESULTS OF SEDIMENTATION AND ELUTRIATE TESTS FROM OSAKA BAY SEDIMENT,
Japan Sediments Management Association.
For primary bibliographic entry see Field 2J.
W87-03258

PARTIAL REVIEW OF DREDGED MATERIAL DISPOSAL TECHNIQUES,
Nishiki Consultant Co. Ltd., Tokyo (Japan).
For primary bibliographic entry see Field 5E.
W87-03259

PRINCIPLES AND PRACTICES FOR THE OCEAN DISPOSAL OF DREDGED MATERIAL: THE LONDON DUMPING CONVENTION RE-EXAMINED,
New Orleans Board of Commissioners of the Port, LA.
For primary bibliographic entry see Field 5E.
W87-03267

ENVIRONMENTAL CONSERVATION IN THE PORT OF MAIZURU,
Kyoto Civil Engineering and Construction Dept. (Japan).
T. Matsuoka.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 380-397, 7 fig, 7 tab, 1 ref.

Descriptors: *Maizuru City, *Water pollution sources, *Wood wastes, *Japan, *Cleanup operations, Management planning, Organic matter, Chemical oxygen demand.

Maizuru City is the key city in the northern part of Kyoto Prefecture, Japan with a population of 98,000. The port of Maizuru has diversified functions including fishery, Maritime Self-Defense Force, and marine recreation. To assess the effectiveness of the current cleaning operations in the Port of Maizuru, the potential release load of organic matter and noxious substances from the wood and bark into the seawater should be estimated. The sinking wood and bark cause two adverse effects. First, deposition on the sea bottom has a considerable influence upon benthos and consequently upon fishery. Second, organic matter released from sinking wood and bark causes a degeneration in the quality of the seawater environment (increase in COD) in the bay. If no recovery operation were carried out and peeled-off bark were allowed to accumulate to 30 cm thick, the sea bottom area covered with peeled-off bark would be approximately 6,000 sq m, and the annual volume of organic matter released into the seawater from free bark would be 73.4 kg for northern timber and 64.4 kg for American timber, with a total volume of 137.8 kg. From this, it can be concluded that bark recovery operations may be effective in reducing this potential contaminant release load into the seawater. The annual mean recovery volume of sinking wood over the past 3-year period was 500/cu m. When converted into volume of organic matter released by using the release rate for northern timber, the value is 1.31 kg annually, and is 1.60 kg annually when converted by using the release rate and the cargo rate for the wood of norther, southern, and American origin. These values suggest the effectiveness of the recovery work in reducing the potential organic load. (See also W87-03248) (Lantz-PTT)
W87-03269

MUSSEL WATCH PROGRAM/MONITORING THE LONG-TERM EFFECTS OF DREDGED MATERIAL DISPOSAL IN NEW ENGLAND WATERS,
Corps of Engineers, Waltham, MA. New England Div.
R. C. Semonian, and C. J. Lindsay.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 398-402, 7 ref.

Descriptors: *Mussels, *Bioindicators, *Dredging, *Spoil disposal, *New England, *Path of pollutants, Fate of pollutants, Spatial variation, Temporal variation, Tissue analysis.

The purpose of monitoring the disposal of dredged material in ocean waters is to identify, measure, and quantify significant impacts to the marine environment surrounding the point of discharge. Some 15 years ago the New England Division, U.S. Army Corps of Engineers began its pursuit of the environmental consequences of dredged material disposal by contracting marine laboratories and universities to conduct field observations of specific dumping events. Recognizing that a structured and interdisciplinary program would contribute significantly to the monitoring efforts, the Division formalized the Disposal Area Monitoring System, or DAMOS. The use of mussels as pollution indicators in dredged material management stands as an example of the DAMOS approach in that it represents monitoring concepts that have the potential of integrating physical, chemical, and biological processes that occur with the disposal of dredged material in the marine environment. The role of marine bivalve mollusks in extracting trace metals from the marine environment and concentrating the metals in their tissues had been well established prior to our integrating a mussel program in DAMOS. And, in fact, bivalves had been used as sentinel organisms in monitoring environmental quality. Studies had shown that the uptake of trace metals by bivalve mollusks is reflective of metals in the environment – water temperature, physiological state, and organism size are other factors – and that the uptake reversed as the concentration of metals diminished. The horse mussel and the blue mussel were selected for monitoring DAMOS sites located north and south, respectively, of Cape Cod which separates the two tidal systems impacting the New England coastline. The plan was to establish experimental stations at four northern and six southern disposal sites. Data were subjected to intensive statistical analysis. The results indicated that peak concentrations tend to occur during periods of increased suspended load in the water column attributable both to natural meteorological events and dredged material disposal. These observations, when compared with sediment transport studies being conducted under the DAMOS program, showed that spatial and temporal effects of dredged material are several orders of magnitude smaller than those induced by natural storm events. (See also W87-03248) (Lantz-PTT)
W87-03270

DISSOLVED LOADS OF RIVERS AND SURFACE WATER QUANTITY/QUALITY RELATIONSHIPS.
International Association of Hydrological Sciences.
Available from the International Association of Hydrological Sciences, 200 Florida Ave., NW, Washington, DC. 20009. Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophys-

ics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication No. 141, 1983. Edited by B. w. Webb. 441 p.

Descriptors: *Dissolved solids, *Rivers, *Surface water, *Water quality, Spatial distribution, Temporal distribution, Solute transport, Water pollution sources, Path of pollutants, Water resources development, Model studies.

These proceedings are divided into three major sections and in each the first paper provides a more general review of the theme. Spatial and temporal variations in dissolved loads and solute concentrations are discussed first and individual papers highlight global, continental, regional and more local spatial variations. Studies in the United States, Africa, India and Western and Eastern Europe are reported and findings from contrasting environments, including glacierized mountains and agricultural lowlands, are presented. Within this section, papers also focus on the temporal response of dissolved substances and loads to discharge and other factors which have been revealed through detailed investigation of individual storm events and by statistical analysis of records from more routine water quality monitoring. A second group of papers is concerned with sources of dissolved material, solute budgets and denudation. Atmospheric and geological sources of stream solutes are considered, and the quantification of weathering reactions, undertaken in one paper for sandstone and shale lithologies, emerges as a particularly worthwhile objective in studies of solute production. The important, but sometimes overlooked, influence of biological controls on chemical mass balances is stressed in several papers and the theme of solute budgeting is addressed not only for the river but also for lacustrine and estuarine environments. The magnitude of dissolved and particulate loads and the balance of chemical and mineral denudation are also discussed in this section at countrywide and drainage basin scales. Application of surface water quantity/quality relationships to the utilization and management of water resources constitutes a third theme, and this group of papers encompasses a discussion of the impact, in general, of hydraulic projects and more specific studies of the consequences of river regulation and the role of stormwater detention basins in quality control. (See also W87-03273 - W87-03307) (Lantz-PTT)
W87-03272

DISSOLVED LOADS OF RIVERS: A GLOBAL OVERVIEW,
Exeter Univ. (England).
D. E. Walling, and B. W. Webb.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 3-20, 8 fig, 41 ref.

Descriptors: *Dissolved solids, *Rivers, *Path of pollutants, Solute transport, Temporal distribution, Spatial distribution, Multivariate analysis, Data interpretation, Data collection.

Values of mean annual total dissolved loads have been assembled from 490 rivers located throughout the world and these data have been used to review the general characteristics of dissolved load transport. Attention is given to the magnitude of dissolved loads and their spatial variation, the temporal variation of dissolved load transport and the relationship between the magnitude of the dissolved and particulate components of total load. Although this global analysis of dissolved loads is necessarily restricted by the limited availability of data in both space and time and by its generalized approach, some meaningful patterns are apparent. The production of an acceptable map of global variations in dissolved loads must, however, await the extension of measurement activity to areas of the world for which little or no data are available, and further multivariate analysis of the influence of climate, geology and other physiographic factors would be facilitated by the collection of data from relatively small basins exhibiting essentially homogeneous conditions. Moreover, extension of such a study to consider individual ions as well as the total solute content would provide further information on the relative importance of these controls in influencing various solute sources. It is to be hoped that data collection and processing activities will expand over the next decade and that more detailed analysis will extend and improve current knowledge of the dissolved loads of rivers. (See also W87-03272) (Lantz-PTT)
W87-03273

VARIATION IN SOLUTE CONCENTRATION WITHIN THE RIVER ALMOND AND ITS EFFECT ON THE ESTIMATED DISSOLVED LOAD,
Ministry of Higher Education and Scientific Research, Baghdad (Iraq).
M. H. Al-Jabbari, N. A. Al-Ansari, and J. McManus.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 21-29, 4 fig, 1 tab, 15 ref.

Descriptors: *Dissolved solids, *Path of pollutants, *River Almond, Water pollution effects, Solute transport, River Tay, Rainfall-runoff relationship Model studies, Seasonal variation.

The dissolved solids concentration and load passing a gaged point on the River Almond into the River Tay, Scotland, was estimated from flow duration and dissolved load rating curves for three successive water years in order to determine long period variation and responses to different water conditions. The concentration of dissolved matter exhibits an inverse relationship with water discharge, and ranged between 47 and 88 mg/L. Over the summer season the concentration was higher, more stable, and less scattered, with much stronger correlation to flow level than in the winter season. Of the controls which might affect dissolved solids production and concentration in the Almond catchment, the rainfall-runoff factor seems to be the most important. A long term interrelationship between water discharge and dissolved solids concentration in the River Almond indicates that the response of total solute concentration to the individual storm events lends itself to interpretation in terms of a simple dilution model. The dissolved load passing the Almondbank gaging stating in the study period ranged between 5125 tons in the 1972/1973 (dry water year) and 7326 tons in 1974/1975 (average wet water year). During the summer season an appreciable amount of dissolved loads were transported (up to 44%) and a seasonal variation in the dissolved load and concentration curves was also recognized. Estimates of annual dissolved load transport based on seasonal rating curves applied to the whole year differ by up to 20%, and it is, therefore, recommended that estimation of dissolved loads should be undertaken by deriving and applying rating relationships for seasonal or even shorter periods. (See also W87-03272) (Lantz-PTT)
W87-03274

PHYSIOGENIC AND ANTHROPOGENIC CONTROLS OF GLOBAL AND REGIONAL IONIC RUNOFF,
Martin-Luther-Univ. Halle-Wittenberg, Halle (German D.R.). Sektion Geographie.
For primary bibliographic entry see Field 2E.
W87-03275

SOLUTE YIELD FROM A GLACIERIZED HIGH MOUNTAIN BASIN,
Victoria Univ. of Manchester (England). Dept. of Geology.
D. N. Collins.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 41-49, 3 fig, 2 tab, 16 ref.

Descriptors: *Solute transport, *Glaciers, *Water pollution sources, Conductivity, Snowmelt, Switzerland, Ion transport, Sodium, Potassium, Magnesium, Calcium, Dissolved solids, Cations, Flow discharge.

Electrical conductivity and discharge of meltwaters in the Gornera, which drains from the basin of Gornergletscher, Pennine Alps, Switzerland, were monitored for extended periods during the 1978-1979 hydrological year. Samples of meltwater were analyzed for the cations Na(+), K(+), Mg(2+), and Ca (2+) by atomic absorption spectrophotometry. Relationships between individual and sums of cations with electrical conductivity were ascertained. Rhythmic diurnal inverse variations of solute transport occurred roughly in phase with those of discharge. The relationship between load and discharge is nonlinear, and middle-range flows account for the highest transport of solute load. The annual gross cationic denudation rate was estimated as 478.1 meq/sq m/yr (net of precipitation input 454.0 meq/sq m/yr), which is significantly higher than continental averages. Almost all the dissolved load was transported during the summer ablation season. (See also W87-03272) (Author's abstract)
W87-03276

DISSOLVED MATERIAL CONCENTRATION IN SURFACE WATERS OF AFRICA. TWO CONTRASTING EXAMPLES IN THE RIVERS OF TOGO AND THE MEDJERDAH IN TUNISIA (EVOLUTION DE LA CONCENTRATION EN MATIERES DISSOUTES EN AFRIQUE. DEUX EXEMPLES OPPOSES: LES FLEUVES DU TOGO ET LA MEDJERDAH EN TUNISIE),
Office de la Recherche Scientifique et Technique Outre-Mer, Bondy (France).
J. Colombani.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 51-69, 13 fig, 2 tab, 4 ref.

Descriptors: *Dissolved solids, *Surface waters, *Africa, Togo, Tunisia, Geography, Path of pollutants, Rivers, River flow, Flow discharge.

Geographical variability of dissolved matter concentration in surface water is very important in Africa. It is related not only to geology but also to climate. Contrasting examples are presented for rivers in Togo, where dissolved substances concentration is generally very low, and for the Medjerdah, Tunisia, where concentrations are among the highest in the world. Dissolved substances composition and its seasonal variability are studied and also the specific discharge of dissolved substances is investigated. In conclusion, dissolved substances brought to oceans are compared with salts in oceans with reference to composition as well as quantity. (See also W87-03272) (Author's abstract)
W87-03277

TREND ANALYSIS OF WATER QUALITY IN THE SABARMATI RIVER AT AHMEDABAD FOR A DECADE (1969-1978),
Council of Scientific and Industrial Research, New Delhi (India).
For primary bibliographic entry see Field 5G.
W87-03278

DISSOLVED LOADS IN STREAMS AND RIVERS - DISCHARGED AND SEASONALLY RELATED VARIATIONS,
Eidgenoessische Anstalt fuer Wasserversorgung, Abwasserreinigung und Gewaesserschultz, Duebendorf (Switzerland).
J. S. Davis, and H. M. Keller.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 79-89, 9

fig, 1 tab, 12 ref.

Descriptors: *Dissolved solids, *Streams, *Rivers, *Path of pollutants, Flow discharge, Seasonal variation, Rhine River, Lake Constance, Chemical properties, Hydrologic properties.

Basins of various sizes have been compared to examine behavior patterns of chemical and hydrological parameters under different geological and climatic conditions. Data from small forested basins up to 1 sq km, middle sized river systems up to 10,000 sq km, and several stations on the River Rhine below Lake Constance were used. Basins were investigated with varying degrees of sampling intensity, depending on size and the immediate aims of the particular study. In general the major physical parameters were recorded continuously, and chemical parameters were determined for continuous composite samples from large basins. Frequent grab samples were taken in smaller basins. The basic sampling regime permitted the examination of annual periodicity in fluctuations. The variance of dissolved loads in streams and rivers is markedly reduced when data evaluation includes consideration of the annual cyclic pattern. In the present study this behavior has been identified for a number of parameters, and annual patterns are similar for small and large basins. The recognition of basin-independent patterns aids comparison of data from basins varying in size and other characteristics. (See also W87-03272) (Author's abstract)
W87-03279

MULTIVARIATE ANALYSIS OF QUALITY PARAMETERS TO DETERMINE THE CHEMICAL TRANSPORT IN RIVERS,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
J. Feher.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 91-98, 3 fig, 1 tab, 10 ref.

Descriptors: *Multivariate analysis, *Water quality, *Path of pollutants, *Rivers, Chemical analysis, Hungary, Water quality control, Water sampling, Statistical analysis, Calcium, Sodium, Potassium, Chlorides, Bicarbonates, Nitrites, Ammonia.

In Hungary at present, water quality analyses are performed on samples obtained at nearly 300 surface water quality sampling locations. The length and sampling frequency of the data series vary according to the importance of the sampling locations. The weekly or biweekly sampling frequency makes the determination of chemical massflux possible only with limited accuracy. Good correlations exist between anions and cations of high mean concentration and natural origin and those parameters which can be measured continuously. For the sections under study, regression functions were obtained for Ca(2+), Na(+), K(+), Cl(-) and total dissolved materials (TDM) in the case of the River Maros at Mako; for Ca, Cl(-), alkalinity and TDM in the case of the River Sajo at Sajopuspoli; for Ca(2+), HCO3(-), TDM, NO3(-) and NH4(+) in the case of the River Danube at Baja; and for HCO3(-), total hardness, alkalinity and Na(+) in the case of the River Zala at Fenekpuszta. The regression correlations for the components listed, when compared to the functions derived from five independent variables using stepwise methods, showed that no significant difference existed between the relative standard deviation of residuals and that of the square sum of deviations. In summary, it can be concluded that a particular water quality components can be substituted by values computed from regression functions only if the regression function is < = 10% for the function and standard deviation of error < = 10% for the control. (See also W87-03272) (Lantz-PTT)
W87-03280

MECHANISMS OF DISSOLVED SOLIDS TRANSPORT IN FLYSCH DRAINAGE BASINS,
Polish Academy of Sciences, Krakow. Inst. of Geography and Spatial Organization.
W. Froehlich.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 99-108, 9 fig, 12 ref.

Descriptors: *Solute transport, *Dissolved solids, *Catchment areas, *Path of pollutants, Runoff, Precipitation, Regression analysis, Mathematical analysis, Statistical analysis, Chemical analysis.

The transformation of precipitation input into runoff is accompanied by a continuous change in the chemical properties of water involved in the water circulation cycle. These range from slightly acid precipitation water, through neutral stream water to alkaline underground waters. The relationship between discharge and total dissolved solids concentration conforms to a curved regression equation, in the form y = a to the x - b. Changes in total dissolved solids concentrations follow a certain pattern which is controlled by the smallest drainage basin areas and their relation to the trunk stream. The nature of relationships that approximate spatial variation in chemical denudation parameters for a small drainage basin reflects the distinct differences existing between symmetrical and asymmetrical drainage basins. The variations in unit chemical denudation rates with increasing basin area can be expressed by a hyperbolic equation, in the form y = (ax - b)/x. (See also W87-03272) (Author's abstract)
W87-03281

RUNOFF PROCESSES AND DISSOLVED SUBSTANCES DURING FLOOD EVENTS IN SMALL DIFFERENTLY USED DRAINAGE AREAS,
Wahnbachtalsperrenverband, Siegburg (Germany, F.R.).
For primary bibliographic entry see Field 2E.
W87-03283

REGIONAL ANALYSIS OF WATER QUALITY IN MAJOR STREAMS OF THE UNITED STATES,
Woodward-Clyde Consultants, Englewood, CO.
For primary bibliographic entry see Field 5G.
W87-03284

FACTORS CONTROLLING THE CHEMICAL COMPOSITION OF RIVER WATERS OF INDIA,
Jawaharlal Nehru Univ., New Delhi (India). School of Environmental Sciences.
For primary bibliographic entry see Field 2E.
W87-03285

STREAM SOLUTE BEHAVIOUR IN THE RIVER EXE BASIN, DEVON, UK,
Exeter Univ. (England).
B. W. Webb, and D. E. Walling.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 153-169, 8 fig, 40 ref.

Descriptors: *Solute transport, *Exe River, *Water quality, Temporal distribution, Flow discharge, Water sampling, Water analysis.

The major findings of a long-term study specifically designed to investigate stream solute levels in the sizable river network (1500 sq km) of the Exe basin, Devon, UK are reported and reveal considerable variability and complexity of behavior in space and in time. Marked spatial ranges and patterns of baseflow solute levels are apparent, but details of spatial variation and the controlling factors responsible differ between individual solute parameters. Temporal solute behavior, in terms of annual regime and general response to discharge fluctuations, also exhibits considerable variety between different stations and solute parameters. Detailed monitoring of tributary streams has revealed strong differences in the responses of individual ions both within and between storm events, and complexity of solute behavior is compounded at mainstream sites by aggregation and transmission processes. Studies of water composition at tributary and main channel stations are thought to offer considerable scope for further understanding of stream solute behavior in the study basin. (See also W87-03272) (Author's abstract)
W87-03286

ATMOSPHERIC INPUTS AND RIVER TRANSPORT OF DISSOLVED SUBSTANCES,
Ecole Normale Superieure, Paris (France). Lab. de Geologie.
For primary bibliographic entry see Field 2B.
W87-03287

WEATHERING REACTIONS, WATER CHEMISTRY AND DENUDATION RATES IN DRAINAGE BASINS OF DIFFERENT BEDROCK TYPES: I - SANDSTONE AND SHALE,
Geological Survey, Reston, VA.
For primary bibliographic entry see Field 2K.
W87-03288

DENUDATION OF THE PICEANCE CREEK BASIN, COLORADO,
Geological Survey, Denver, CO.
For primary bibliographic entry see Field 2J.
W87-03289

NUTRIENT AND SEDIMENT BUDGETS FOR THE TIDAL POTOMAC RIVER AND ESTUARY,
Geological Survey, Reston, VA.
J. P. Bennett.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 217-227, 4 fig, 2 tab, 10 ref.

Descriptors: *Sediment budgets, *Tidal rivers, *Estuaries, *Potomac River, Cycling nutrients, Suspended sediments, Salts, Path of pollutants, Solute transport, Model studies, Chesapeake Bay, Nitrogen, Phosphorus, Silica, Water pollution sources.

Twice-weekly salt, suspended sediment, and nutrient species samples were collected during the 1979-1981 water years at six stations along the 101 nautical mile tidal reach of the Potomac River between Washington, DC, and Chesapeake Bay. The concentration data were used to continuously calibrate a hybrid one-layer, two-layer kinematic transport model. Monthly loads computed by the calibrated model were used together with point and nonpoint source data to compute nutrient and sediment budgets for three zones of the tidal Potomac. All of the 815,000,000 tons of sediment supplied during the study period were trapped in the study area; 13,000 tons were from Chesapeake Bay. 82% of the supplies of both total nitrogen and total phosphorus were trapped, but only 9% of dissolved silica. Most of nitrogen and phosphorus were retained in the estuarine zone, most of the sediment and silica in the tidal river. (See also W87-03272) (Author's abstract)
W87-03290

DISSOLVED AND PARTICULATE LOAD IN DANISH WATER COURSES,
Copenhagen Univ. (Denmark). Inst. of Geography.
B. Hasholt.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August

15-27, 1983. IAHS Publication 141, 1983. p 255-264, 2 fig, 3 tab, 21 ref.

Descriptors: *Dissolved solids, *Particulate matter, *Pollution load, *Denmark, Suspended solids, Denudation, Erosion, Erosion rates, Bicarbonates, Chlorine, Nitrite.

Danish water courses can roughly be divided into two categories. In West Jutland, rivers drain towards the North Sea, flow mainly through outwash plains and low-relief moraines of Saale age, and exhibit rather low values of dissolved load. In the rest of this country water courses flow towards the Kattegat and the Baltic, drain mainly young morainic deposits, and have higher values of dissolved load but low particulate load. For selected rivers in each category, total load has been determined from measurements of bed, suspended and dissolved loads. While bed load and suspended load clearly contribute to the real denudational rate, only the weathering share of the dissolved load should be included. The values from Ansager As can be considered to represent minimum denudation rates in West Jutland. Assuming dynamic equilibrium between rainfall (22 t/sq km/yr) and throughflow, and assuming that throughflow of HCO3, Cl, and NO3 is about 10 t/sq km/yr, the resulting estimate of dissolved load from weathering is 22 t/sq km/yr, and the corresponding denudational rate is about 30 mm/kyear. If the same line of reasoning is used for the Susa, contributions from rainfall (12 t/sq km/yr) and throughflow (10 t/sq km/yr) should be subtracted from the total dissolved load to give a denudational rate of about 45 mm/kyear. (See also W87-03272) (Lantz-PTT)
W87-03293

STREAM SOLUTE SOURCES AND VARIATIONS IN A TEMPERATE GRANITE DRAINAGE BASIN,
Plymouth Polytechnic (England). Dept. of Geographical Sciences.
A. G. Williams, J. L. Ternan, and M. Kent.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 299-310, 4 fig, 5 tab, 17 ref.

Descriptors: *Water pollution sources, *Catchment basins, *Streams, Fate of pollutants, Path of pollutants, Precipitation, Water analysis, Chemical analysis, Sodium, Chlorides, Magnesium, Hydrogen ion concentration, Narrator Brook, England, Silica, Granite.

Bulk precipitation and stream water samples were analyzed to determine a chemical budget (February 1977-February 1978) for a small granite basin on Dartmoor, southwest England. Seventy percent of the solute load was derived from external sources, the remaining 30% coming from internal sources. Principal components analysis (PCA) was employed to examine variations in and controls of the solute chemistry from selected pathways. In the study period, 90% of the solute load entering the study basin from the atmosphere was derived from marine sources and only 10% had a terrestrial origin, which reflects the proximity of the Narrator Brook to the sea. In terms of stream output, the proportions of solute load contributed from marine and terrestrial sources change to approximately 70% and 30% respectively. Silica is an important component of the load derived from terrestrial sources, and despite the very low amounts of calcium present in the granite bedrock (0.55% s CaO), this ion represents 10% of the weathering loss and is highly mobile. Solute variations in bulk precipitation were dominated by sodium, chloride and magnesium derived from marine sources, and seasonal trends were related to prevailing weather conditions. The solute chemistry of springs was also found to depend mainly on the influence of marine derived ions. PCA was used to isolate groupings of springs, and the effect of the sitka spruce forest was identified. Annual solute variations in the stream were mainly a function of changes in the concentration of sodium, chloride and magnesium, pH and silica. Stream water chemistry is controlled mainly by processes in the atmosphere, but weathering in the soil is also important. (See also W87-03272) (Lantz-PTT)
W87-03296

DISSOLVED AND SUSPENDED LOADS OF THE REGULATED RIVER NIDDA IN THE RHINE-MAIN AREA,
Frankfurt Univ. (Germany, F.R.).
W. L. F. Brinkmann.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 347-357, 1 fig, 9 tab, 6 ref.

Descriptors: *Suspended load, *Dissolved solids, *Nidda River, *Rhine River, *Water quality, Suspended solids, Heavy metals, Calcium, Magnesium, Sodium, Potassium, Chlorine, Bicarbonates, Sulfates, Cadmium, Copper, Nickel, Cobalt, Chromium, Lead, Zinc, Seasonal variation, Peak loads.

Over a period of two years, the daily load of macro- and trace constituents of the regulated River Nidda, Germany and its tributaries were analyzed for the liquid and solid phases and the bed sediment. Parameters analyzed were runoff, total suspended solids (TSS), suspended sediment-bound heavy metals, total dissolved solids (TDS), dissolved constituents such as Ca(2+), Mg(2+), Na(+), K(+), Cl(-), HCO3(-), SO4(3-) and the heavy metals Cd, Cu, Ni, Co, Cr, Pb, Zn. The TSS/TDS relationship displays the dominance of dissolved loads for low water periods and winter floods. For summer floods, primarily generated by heavy cloudbursts, the TSS/TDS relation demonstrates the TSS to be the main load during rising stage. The maximum TSS load does not coincide with peak discharge. The heavy metal loads in the solute and solid phases are low compared with polluted rivers of West Germany, and the same situation exists for the concentrations of heavy metals in bed sediment. An important source for heavy metals are storm water flows from tributaries which drain suburban or urban areas. (See also W87-03272) (Author's abstract)
W87-03299

NUMERICAL SIMULATION RELATING LAND USES WITHIN A DRAINAGE BASIN TO THE DOWNSTREAM RIVER WATER QUALITY (SIMULATION NUMERIQUE DE L'INFLUENCE DES PRATIQUES CULTURALES DANS UN BASIN VERSANT SUR LA QUALITE DES EAUX A SON EXUTOIRE),
Centre National de la Recherche Scientifique, Toulouse (France). Inst. de Mecanique des Fluides.
For primary bibliographic entry see Field 6G.
W87-03300

NITRATE LOAD/DISCHARGE RELATIONSHIPS AND NITRATE LOAD TRENDS IN DANISH RIVERS,
Miljoestyrelsen, Copenhagen (Denmark).
C. Hagebro, S. Bang, and E. Somer.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 377-386, 7 fig, 2 tab, 13 ref.

Descriptors: *Nitrates, *Pollution load, *Denmark, *Water pollution sources, *Fate of pollutants, Path of pollutants, Nitrogen, Fertilizers, Gudena River, Karup River, Odense River, Skjern River, Solute transport, Seasonal variations.

The use of chemical nitrogen fertilizer in Denmark has increased rapidly over recent decades. The consumption has nearly doubled from 1967-1968 to 1979-1980 when respectively 7.8 and 13.5 t N/sq km were used. Furthermore, the manurial value of manure from livestock is not often assessed, so that too much nitrogen is applied to the fields. Investigations of drainage water have shown that nitrate leaching increases when the application of N-fertilizer increases. When a certain level is reached further fertilizer application sharply increases the nitrate concentration in drainage water. In the last few years, increased levels of nitrate have been noticable in the groundwater in certain parts of the country. This has caused alarm, since 98% of the drinking water supply in Denmark comes from groundwater. In the present paper time series of nitrate transport in selected Danish rivers are discussed in order to elucidate if in fact there has been increased nitrate runoff from representative basins in Denmark since 1967. Discharge and nitrate transport by four Danish Rivers (Genda, Karup, Skjern, and Odense) have been investigated over the period from 1967 to 1981. The overall conclusion of this study is that the annual transport of nitrate in the study rivers is largely influenced by varying climatic conditions. Only the Skjern River discharging to the North Sea shows a long term positive trend in nitrate transport which is distinguishable from variations due to climatic effects. However, when the climatic effect is filtered out, Skjern River and Karup River both exhibit a significant positive trend in nitrate transport, which probably is correlated with increases in fertilizer use and structural changes in agriculture, since waste water discharges of nitrates have only a relatively unimportant influence in these rivers. For the Gudena and Odense Rivers, no significant trend has been found. (See also W87-03272) (Lantz-PTT)
W87-03302

HEAVY METAL CONTENT IN SEDIMENTS OF LAKES IN SOUTHERN BAVARIA AS A SIGN OF LONG-TERM ENVIRONMENTAL IMPACT,
Munich Univ. (Germany, F.R.). Geographische Inst.
For primary bibliographic entry see Field 5C.
W87-03305

INFLUENCE OF CATASTROPHIC FLOODS ON WATER QUALITY AS RECORDED IN THE SEDIMENTS OF BLAGDON LAKE, ENGLAND,
Polytechnic Wolverhampton (England).
For primary bibliographic entry see Field 2H.
W87-03306

COMPARISON OF WATER QUALITY IN DRAINAGE BASINS UNDER AGRICULTURAL AND FOREST LAND USE,
Giessen Univ. (Germany, F.R.). Inst. fuer Mikrobiologie und Landeskultur.
For primary bibliographic entry see Field 2E.
W87-03307

GROUNDWATER: ITS OCCURRENCE, MOVEMENT AND POTENTIAL FOR POLLUTION,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 2F.
W87-03309

ACID RAIN: A REVIEW OF THE PHENOMENON IN THE EEC AND EUROPE.
Commission of the European Communities, Luxembourg.
For primary bibliographic entry see Field 5C.
W87-03338

DRINKING WATER MATERIALS: FIELD OBSERVATIONS AND METHODS OF INVESTIGATION,
Bonn Univ. (Germany, F.R.). Hygiene Inst.
For primary bibliographic entry see Field 5F.
W87-03340

5C. Effects Of Pollution

TOXICITY TESTS OF AQUATIC POLLUTANTS BY USING COMMON DUCKWEED,
Illinois State Water Survey, Peoria. Water Quality Section.

For primary bibliographic entry see Field 5A.
W87-02582

EFFECTS OF FOUR AGRICULTURAL PESTICIDES ON DAPHNIA PULEX, LEMNA MINOR, AND POTAMOGETON PECTINATUS,
Columbia National Fisheries Research Lab., MO.
W. A. Hartman, and D. B. Martin.
Bulletin of Environmental Contamination and Toxicology BECTA6, Vol. 35, No. 5, p 646-651, November 1985. 2 fig, 1 tab, 6 ref.

Descriptors: *Water pollution effects, *Pesticides, Daphnia pulex, Lemna minor, Potamogeton pectinatus, Atrazine 4L, Furadan 4, Lasso, Roundup, Carbofuran, Alachlor, Glyphosate, Toxic effects.

Commercial liquid formulations of four pesticides, Atrazine 4L (40.8% atrazine), Furadan 4 (40.6% carbofuran), Lasso (45.1% alachlor), and Roundup (41% glyphosate) were tested. Acute toxicity tests with D. pulex and L. minor were conducted with and without suspended sediment. The results indicated that suspended sediment had little influence on the acute toxicities of alachlor, atrazine, or carbofuran to D. pulex and L. minor. Alachlor, atrazine, and glyphosate are listed by the Committee of Scientists of the Agricultural Research Service (1975) to be potentially adsorbed onto suspended sediment; however, only the toxicity of glyphosate was significantly affected. Carbofuran has little or no potential for adsorption and behaved in the same manner as alachlor and atrazine. (David-PTT)
W87-02589

VALIDATION OF A PROGNOSIS BASED UPON A EUTROPHICATION MODEL,
Royal Danish School of Pharmacy, Copenhagen.
S. E. Jorgensen, L. Kamp-Nielsen, T. Christensen, J. Windolf-Nielsen, and B. Westergaard.
Ecological Modelling, Vol. 32, No. 1-3, p 165-182, June 1986. 10 fig, 6 tab, 16 ref.

Descriptors: *Eutrophication, *Model validation, *Lakes, *Nutrients, *Glumso Lake, *Wastewater diversion, *Prediction, Nitrogen, Phosphorus, Carbon, Mathematical models, Denmark, Phytoplankton, Species composition, Municipal wastewater.

A lake eutrophication model incorporating independent cycles of N, P, and C was used to predict the outcome of diversion of wastewater from Glumso Lake, Denmark, which had for several years received mechanically-biologically treated wastewater from a community of 3000 inhabitants and almost no industry. The characteristics of two versions of the eutrophication model are described and the predicted and observed effects of wastewater diversion on limnological parameters are compared. The prognosis gave the right trend in reduction of the eutrophication and nutrient concentrations, but the predicted and observed values were out of phase (temporally) and Y (the general standard deviation) was significantly higher than found by an earlier validation, due to a shift in phytoplankton composition. It is suggested that addition of a control function might improved the results. Flexible structure models appear to be the right approach for making predictions in circumstances where changes in impacts are drastic. (Rochester-PTT)
W87-02602

EFFECTS OF WATER QUALITY PARAMETERS ON THE CORROSION OF GALVANIZED STEEL,
Environmental Science and Engineering, Inc., Gainesville, FL.
For primary bibliographic entry see Field 5G.
W87-02608

WATERBORNE VIRAL GASTROENTERITIS,
Health Effects Research Lab., Cincinnati, OH.
F. P. Williams, and E. W. Akin.
Journal of the American Water Works Association JAWWA5, Vol. 78, No.1, p 34-39, January 1986. 1 fig, 2 tab, 49 ref.

Descriptors: *Waterborne diseases, *Viral gastroenteritis, *Microbiological studies, Gastroenteritis, Electron microscopy, Rotavirus, Bacteria, Microorganisms, Cell culture, Norwalk virus, Snow Mountain agent.

Acute gastroenteritis is almost as common as the cold as the most frequent illness affecting Americans. There are many causes of gastroenteritis, including microorganisms in the bacterial, parasitic, and viral categories. Since early in the 1970's a number of newly identified viral gastroenteritis agents have been reported. Of those reported, Norwalk virus, rotavirus, and the Snow Mountain agent have been implicated in waterborne outbreaks of the illness. Since these agents could not be readily detected using routine cell culture procedures, progress in their characterization has been slow. Unfortunately, understanding of their environmental significance remains fragmentary, and their detection in water supplies depends to a great extent on the development of more practical and efficient methods for their identification. (David-PTT)
W87-02612

RED ALDER LEAF LITTER AND STREAMWATER QUALITY IN WESTERN OREGON,
Oregon State Univ., Corvallis. Dept. of Forest Engineering.
For primary bibliographic entry see Field 5B.
W87-02631

DETECTION AND HEALTH RISK ASSOCIATED WITH LOW VIRUS CONCENTRATION IN DRINKING WATER,
Institut Armand-Frappier, Laval (Quebec). Centre de Recherche en Virologie.
For primary bibliographic entry see Field 5A.
W87-02653

SOME EXPERIMENTAL DISCUSSION OF ACCURACIES IN QUANTITATIVE VIRUS ASSESSMENT FOR WATER SUPPLY,
Kyoto Univ. (Japan).
For primary bibliographic entry see Field 5A.
W87-02656

INTERACTIONS BETWEEN BIOTIC AND ABIOTIC FACTORS AND VIRUSES IN A WATER SYSTEM,
Medizinische Akademie 'Carl Gustav Carus' Dresden (German D.R.). Inst. fuer Allgemeine und Kommunale Hygiene.
For primary bibliographic entry see Field 5B.
W87-02657

ABSENCE OF ACCLIMATION TO PARATHION BY RAINBOW TROUT DURING SUBLETHAL EXPOSURE,
McGill Univ., Montreal (Quebec). Faculty of Engineering.
W. P. Banas, and J. B. Sprague.
Water Research WATRAG, Vol. 20, No. 10, p 1229-1232, October 1986. 2 fig, 1 tab, 29 ref.

Descriptors: *Acclimation, *Rainbow trout, *Water pollution effects, *Parathion, *Insecticides, *Organophosphate compounds, *Sublethal effects, *Toxicity, *Defense mechanisms, Biotransformation, Chronic effects, Bioassay, Uptake, Accumulation, Enzymes, Pre-exposure effects.

After 1, 2, 3 and 5 weeks of pre-exposure to 0.31 mg/l of parathion, rainbow trout did not change their tolerance of lethal levels of the organophosphate insecticide. This pre-exposure concentration represents 0.25 of the mean control incipient lethal concentration. Thresholds of lethality were reached at 120 - 144 h for all lethal tests though mortality commenced 12 - 24 h earlier in lethal tests using pre-exposed fish. Both groups grew during the pre-exposure. Parathion pre-exposed fish also showed reduced appetite and activity. (Author's abstract)
W87-02697

AVOIDANCE-PREFERENCE REACTIONS OF RAINBOW TROUT (SALMO GAIRDNERI) AFTER PROLONGED EXPOSURE TO CHROMIUM(VI),
Virginia Polytechnic Inst. and State Univ., Blacksburg. Center for Environmental Studies.
I. Anestis, and R. J. Neufeld.
Water Research WATRAG, Vol. 20, No. 10, p 1233-1241, October 1986. 11 fig, 26 ref.

Descriptors: *Avoidance, *Rainbow trout, *Water pollution effects, *Chromium, *Acclimation, Chemo-receptive capacity, Toxicity, Water analysis, Water quality standards, Environmental impact, Sublethal effects, Bioassay, Pollutants, Heavy metals, Fish.

Avoidance-preference reactions were studied in rainbow trout pre-exposed for 7 - 20 weeks to potassium dichromate solutions ranging from 0.01 to 3.0 mg/l as Cr(VI). Experiments were performed in a hydraulic channel 9.15 m long by 30 cm wide, partly divided along its length and at a flow depth of 30 cm, combining steep and shallow gradient characteristics. An avoidance threshold value of 0.028 mg/l was determined for a population which had not been previously exposed to Cr while avoidance thresholds for pre-exposed fish increase linearly with the level of pre-exposure. Pre-exposed fish exhibited lower avoidance reactions compared to the non-exposed fish. Avoidance reactions decreased with increasing level of pre-exposure. Fish exposed to test concentrations matching their pre-exposure level clearly preferred the matching concentrations over any adjacent lower or higher test concentrations. After 7 days acclimation in clear water fish previously exposed at 0.01-0.9 mg/l Cr(VI), behaved similarly to the non-exposed fish, indicating functional recovery of chemo-receptive capacity, while fish pre-exposed beyond the 0.8 mg/l level did not recover fully within the same 7 day acclimation period. The 0.8 mg/l Cr(VI) level is proposed as a critical pre-exposure level for short term recovery of normal chemoreceptive capacity. Times of pre-exposure withi the range tested had no influence on avoidance reactions. (Author's abstract)
W87-02698

SEASONAL, BEHAVIORAL AND GROWTH CHANGES OF JUVENILE CORBICULA FLUMINEA EXPOSED TO CHRYSOTILE ASBESTOS,
Oak Ridge National Lab., TN. Environmental Sciences Div.
S. E. Belanger, D. S. Cherry, and J. Cairns.
Water Research WATRAG, Vol. 20, No. 10, p 1243-1250, October 1986. 4 fig, 3 tab, 34 ref. DOI Grants G1134151, G1144151.

Descriptors: *Chrysotile asbestos, *Clams, *Water pollution effects, *Asbestos, Mollusks, Seasonal variation, Bioindicators, Pollutant identification, Accumulation, Fiber uptake, Asiatic clam, Siphoning activity, Mortality, Ultrastructural response.

Juvenile Corbicula fluminea (5.2 - 8.6 mm shell length) were collected in winter (8-12 C) and summer (17-23 C) conditions and tested for responses to chrysotile asbestos at concentrations of 0 - 10 to the 8th power fibers/l for 30 days. Growth, siphoning activity, fiber uptake and gill tissue ultrastructure were evaluated. Siphoning activity was significantly reduced by 30 d exposure at 100 - 10 to the 8th power fibers/l in summer and winter. Differences in shell:tissue growth were apparent with lower values in all groups in the winter compared to their counterparts in the summer due to energy allocations to tissue growth in winter. Therefore, Corbicula were more susceptible to asbestos in winter conditions due to differences in robust, summer vs inherently weakened winter collected clams. Clams exposed to 10 to the 8th power fibers/l accumulated around 150 fibers/mg in gill and 110 fibers/mg in viscera after 30 d in both seasons. The presence of asbestos in tissue was consistent with significantly greater water content and gill locule surface area in 10 to the 8th power fibers/l exposed clams relative to controls. Small asbestos fibers were preferentially accumulated in gill and visceral tissues. Corbicula may

become a useful biomonitor for asbestos contamination in the US and abroad due to its ability to accumulate asbestos fibers efficiently. (Author's abstract)
W87-02699

NITRILOTRIACETIC ACID IN SLUDGE-AMENDED SOIL: MOBILITY AND EFFECTS ON METAL SOLUBILITY,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
For primary bibliographic entry see Field 5E.
W87-02765

PRIMARY AND SECONDARY STRESS RESPONSES OF STRIPED BASS (MORONE SAXATILIS) EXPOSED TO BENZENE,
National Marine Fisheries Service, Tiburon, CA. Tiburon Lab.
R. B. MacFarlane, and P. E. Benville.
Marine Biology MBIOAJ, Vol. 92, No. 2, p 245-254, August 1986. 8 fig, 1 tab, 68 ref.

Descriptors: *Sublethal effects, *Acclimation, *Stress, *Bass, *Benzene, *Water pollution effects, *Toxicity, Fish, Blood, Liver, Fish physiology, Animal physiology, Biochemistry.

Striped bass (Morone saxatilis) were collected from the San Francisco Bay-Delta estuary in 1982 from areas distant from pollution sources. After acclimatization, plasma cortisol concentration (primary response) and blood biochemicals indicative of energy mobilization (secondary responses) were followed in individuals exposed to sublethal levels of benzene for up to 21 days. Despite the persistence of benzene in blood and liver tissues for the exposure duration, stress responses were moderate and returned to control values within the initial seven days. Plasma cortisol concentrations increased two- to three-fold at eight hours and returned to control levels within 48 hours. Levels of glucose, lactate, H(+), protein, and triglyceride were elevated during the initial four hours to seven days, with protein and triglyceride returning to normal levels prior to the other secondary response variables. From the perspective of the general adaptation syndrome, benzene activated the hypothalamo-pituitary-interrenal axis, resulting in clinical stress responses characteristic of an alarm reaction. The time-courses and amplitudes of primary and secondary responses to benzene suggest the sensory perception of a noxious agent eliciting mild, acute stress followed by adaptation. (Author's abstract)
W87-02771

ECOLOGY AND ESTUARINE IMPACT ASSESSMENT: LESSONS LEARNED FROM THE HUDSON RIVER (U.S.A.) AND OTHER ESTUARINE EXPERIENCES,
Cornell Univ., Ithaca, NY. Ecosystems Research Center.
For primary bibliographic entry see Field 2L.
W87-02776

TOXICITY OF BRASS DUST TO THE MICROALGAE ANKISTRODESMUS FALCATUS AND SELENASTRUM CAPRICORNUTUM,
Chemical Research, Development and Engineering Center, Aberdeen Proving Ground, MD.
M. V. Haley, D. W. Johnson, G. S. Hart, W. T. Muse, and W. G. Landis.
Journal of Applied Toxicology, Vol. 6, No. 4, p 281-285, August 1986. 2 fig, 4 tab, 25 ref.

Descriptors: *Toxicity, *Brass dust, *Algae, *Water pollution effects, *Chlorophyta, *Ankistrodesmus, *Selenastrum, *Heavy metals, Metals, Copper, Zinc, Growth, Clays, Ionization, Ions, Cations, Water pollution.

The toxicity of brass dust was examined in 96-hour growth inhibition tests. Two species of algae were used, Ankistrodesmus falcatus and Selenastrum capricornutum. Brass dissociates into two components, Cu (68.5%) and Zn (27.5%). Algal growth was enhanced at concentrations of 0.01 and 0.001 mg brass/l. Available literature on the toxicity of copper to S. capricornutum indicates that the toxicity of brass dust is attributable to the ionized copper. Reported toxicities of zinc are orders of magnitude lower than copper. The ionization of the brass depends on pH and hardness. The literature cites cases in which copper toxicity varies with pH, clay content, and dissolved organics. Little is known on the fate and distribution of brass dust upon its release into the environment. However, the presence of heavy metals has consistently been shown to affect aquatic systems. (Author's abstract)
W87-02778

MORE AWARENESS SOUGHT CONCERNING ROLE OF METALS IN POLLUTION,
For primary bibliographic entry see Field 5B.
W87-02791

R-PLASMID TRANSFER IN SOIL AND WATER,
Guelph Univ. (Ontario). Dept. of Environmental Biology.
J. T. Trevors, and K. M. Oddie.
Canadian Journal of Microbiology CJMIAZ, Vol. 32, No. 7, p 610-613, July 1986. 1 fig, 1 tab, 17 ref.

Descriptors: *Plasmid transfer, *Microbiological studies, *Public health, *Bacteria, *Aquatic bacteria, *Soil bacteria, Enteric bacteria, Bacterial analysis, Water analysis, Culturing techniques, Eschirichia coli.

Methods are required for studying gene transferability in adapted and genetically engineered bacteria containing plasmids that may eventually be released into noncontaminated locations such as soil and water; moveover, little is known about bacterial gene transfer in soil and water. Therefore, R-plasmid transfer in Escherichia coli was investigated in nutrient broth, sterile soil, and sterile water. Transfer of this plasmid, which confers antibiotic resistance, was observed in broth cultures at 30 and 22 C, but not at 15 C. R-plasmid transfer did not occur at 30, 22, and 15 C in nonamended sterile soil and stream water. The addition of nutrients to sterile stream water and soil allowed plasmid transfer to occur at temperatures ranging from 15 to 30 C. R-plasmid transfer was also observed in soil adjusted from 20% to 100% of its water-holding capacity. (Doria-PTT)
W87-02792

MEDICAL GEOLOGY,
Brooklyn Coll., NY. Dept. of Geology.
E. L. Savage.
Northeastern Environmental Science, Vol. 5, No. 1/2, p 5-11, 1986. 1 tab, 18 ref.

Descriptors: *Water pollution effects, *Fate of pollutants, *Geology, Environmental effects, Diseases, Human diseases.

Medical Geology merges geology, the geobiochemical environmental sciences with medicine, correlating environmental distribution of disease and health patterns with natural and anthropogenic distributions of minerals, trace elements, organic and radioactive materials. Throughout history man and other organisms have slowly evolved to survive with the toxins released into the environment. However, the modern rates and quantities of these toxic materials has increased at a rate far greater than evolution can handle. Water is particularly vulverable to alterations by increases or decreases of natural and anthropogenic additions of materials. The hydrologic cycle ensures that any toxins are not only carried in solution or solid form in all states of water but also in the atmosphere and biosphere of the earth. Water is frequently the route by which toxic substances are delivered to plants and animals which are part of man's food web or by which a toxin is ingested directly. The scope of medical geology includes (1) determination of how the environment distributes toxins and their link to health and disease and (2) dissemination of conclusions concerning their sources and effects to health field professionals and physicians. (Cassar-PTT)
W87-02825

PUBLIC POLICY IMPLICATIONS OF TOXIC CHEMICALS IN DRINKING WATER: A CASE STUDY OF LONG ISLAND, NY,
New York Public Interest Research Group, Inc., NY.
W. Hang.
Northeastern Environmental Science, Vol. 5, No. 1/2, p 12-14, 1986. 9 ref.

Descriptors: *Water pollution effects, *Fate of pollutants, *Public policy, *Drinking water, Water policy, Long Island, New York, Water supply, Organic compounds, Industrial wastes, Landfills, Chemical wastes, Groundwater pollution, Reservoirs, Aquifers, Groundwater.

Long Island, N.Y. was the subject of a three year investigation designed to identify the environmental and health consequences associated with the deterioration of a groundwater reservoir serving the total water supply needs of more than three million people. Based on the results of an Ames Testing Survey and a review of existing regulatory permits, the genesis of a series of unprecedented national environmental laws are being translated into action, the public policy implications of this sole-source aquifer case study are explored. (Author's abstract)
W87-02826

ENVIRONMENTAL IMPACT OF OIL SPILLS AND THE OIL INDUSTRY RESPONSE,
Texaco, Inc., Beacon, NY.
A. H. Lasday.
Northeastern Environmental Science, Vol. 5, No. 1/2, p 35-40, 1986. 24 ref.

Descriptors: *Water pollution effects, *Water pollution sources, *Literature reviews, *Oil spills, *Dispersants, Water quality control, Fate of pollutants, Environmental effects, Cleanup.

Published literature on the fate and effects of crude oil in the marine environment is reviewed. Acute effects are usually associated with major oil spills that result in damage lasting several months or years. Chronic and low level effects are associated with minor spills and leaks or with the aftermath of a major spill. The latter usually produce no significant ecological damage. Improper cleanup of oil spills can increase the damage. In the case of the Torrey Canyon spill off the English Coast, 10,000 tons of toxic dispersant caused extensive damage to marine life. Bulldozers and other heavy equipment compounded damage after the Amoco Cadiz supertanker wreck off the Brittany Coast deposited thick layers of oil in marshes. A successful cleanup is illustrated by the Mexican Ixtoc-I oil well blowout, which was treated by proper application of low-toxicity dispersant. Dispersants remain the most powerful tool for preventing oil spill damage. Mechanical containment and cleanup devices are also very important. The most adverse conditions for an oil spill are as follows: (1) small body of water compared with the volume of oil released, (2) refined oil, and (3) turbulence which churns the oil into the bottom sediments. Prevention of spills is considered the most cost-effective approach. (Cassar-PTT)
W87-02829

ASBESTOS IN POTABLE WATER SUPPLIES AND ATTRIBUTABLE RISK OF GASTROINTESTINAL CANCER,
Mount Sinai School of Medicine, New York. Environmental Sciences Lab.
A. M. Langer, and R. P. Nolan.
Northeastern Environmental Science, Vol. 5, No. 1/2, p 41-53, 1986. 6 tab, 89 ref. National Inst. of Environmental Health Sciences ES00928, National Inst. for Occupational Safety and Health 0H01905.

Descriptors: *Water pollution effects, *Literature reviews, *Potable water, *Asbestos, Cancer, Public health, Human diseases, Mesothelioma.

The relationship between gastrointestinal cancer and ingestion of asbestos in water supplies is reviewed. Human data obtained on occupationally exposed people show that few studies demonstrate

a statistically strong correlation between asbestos exposure and gastrointestinal cancer. In the studies that show a positive correlation, amphibole and mixed fiber type exposure appear to carry greater cancer risk as compared to chrysotile exposure alone. Animal data are negative. Computation of the amount of asbestos found in water and the amounts probably ingested through the gut wall show a lifetime ingestion in the nanogram range. During the years that asbestos use has increased (1930-1985) the incidence of gastrointestinal cancers has decreased. This makes it impossible to epidemiologically resolve the risk factors. (Cassar-PTT)
W87-02830

PHYSIOLOGICAL INNOCUITY OF ASBESTOS IN WATER,
Societe Nationale de l'Amiante, Sherbrook (Quebec).
M. Cossette, P. Delvaux, T. Van Ha, C. L'Esperance, and G. G. Belleville.
Northeastern Environmental Science, Vol. 5, No. 1/2, p 54-62, 1986. 4 fig, 47 ref.

Descriptors: *Water pollution effects, *Drinking water, *Water pollution sources, *Literature reviews, *Asbestos, Pollutant identification, Human diseases, Epidemiology, Water quality control, Air pollution.

Origins of asbestos in water include atmospheric precipitation, asbestos-cement pipe erosion, cooling tower blowdown, and the erosion of asbestos-bearing rocks. The difficulty of asbestos determination are discussed. Animal data show no provable link between ingestion of asbestos fibers and health. Analysis of human data indicated no increased gastrointestinal cancer incidence in residents of Duluth, Minnesota, and Quebec, where drinking water supplies contain high levels of asbestos fibers. At mine and mill sites measures to prevent asbestos from entering water supplies include frequent wetting of the tailings piles to form a hard crust and planting vegetation to control erosion. Corrosion-resistent asbestos-cement pipe is being developed by controlling pore size distribution and using durable coatings of chlorinated rubber. The most promising development is chemical passivation of fibers. This involves treating the asbestos fibers by phosphorylation or other means to produce a physiologically inactive surface. (Cassar-PTT)
W87-02831

HEALTH EFFECTS OF ARSENIC IN THE AQUEOUS ENVIRONMENT,
Texas A and M Univ., College Station. Center for Energy and Mineral Resources.
K. J. Irgolic.
Northeastern Environmental Science, Vol. 5, No. 1/2, p 86-90, 1986. 1 fig, 1 tab, 29 ref.

Descriptors: *Water pollution effects, *Water pollution sources, *Arsenic, *Drinking water, Metals, Public health, Human diseases, Chemical reactions, Cancer, Detoxification.

Arsenic occurs as a component of sulfidic ores in several chemical forms. Weathering of these ores causes arsenic compounds to be dispersed throughout soils, fresh water, and the oceans. Man also uses arsenic in agriculture, industry and medicine. Health problems such as skin disorders, blackfoot (gangrene of the extremities), and cardiovascular disorders are attributed to high concentrations of arsenic in drinking water. Arsenite and arsenate are found in water samples, and their ratio varies considerably. No methylated arsenic compounds were found. However, organic arsenic compounds may be generated in the presence of algae and in mammals, including man. This reaction may serve as a detoxification mechanism. Knowledge about the mechanism of toxicity is rather limited. Indeed, arsenic has medicinal uses and appears to be necessary as a trace element in the diet, at least in some animals. (Cassar-PTT)
W87-02833

MACROPHYTE GROWTH IN SHALLOW STREAMS: FIELD INVESTIGATIONS,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
R. M. Wright, and A. J. McDonnell.
Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 5, P 953-966, October 1986. 8 fig, 5 tab, 15 ref.

Descriptors: *Macrophytes, *Phosphorus, *Aquatic plants, *Streams, *Field tests, Phosphorus removal, Plant growth, Water quality, Wastewater treatment, Trophic level, Yield, Primary productivity, Lotic environment, Rooted aquatic plants, Biomass, Shallow water, Photpynthesis.

Three contrasting segments of a stream (Spring Creek in Central Pennsylvania), exhibiting varying levels of production, were monitored for water quality, oxygen-derived primary productivity and the yield and growth rate of indigenous aquatic plant biomass. Average daily primary productivity rates observed for the respective segments included: 3.9 g O2/sq m/day for a low in-stream phosphorus (22 microgram (ug) total P/L, periphyton-dominated community; 5.5 g O2/sq m/day for a low in-stream phosphorus (17 ug total P/L) mixed periphyton-macrophyte community; 18.3 g O2/sq m/day for an enriched phosphorus (1,340 ug total P/L) macrophyte-dominated community. Additional data are presented for sediment and interstitial sediment water nutrients and macrophyte biomass variations over a growing season. Specific photosynthetic rates estimated for the macrophyte population ranged from 0.005/day to 0.224/day for the low phosphorus environment to from 0.036/day to 0.456/day for the phosphorus-impacted segment. The need to accommodate natural and wastewater-derived in-stream aquatic plant productivity in wasteload allocation analysis is discussed. (See also W87-02888) (Author's abstract)
W87-02887

MACROPHYTE GROWTH IN SHALLOW STREAMS: BIOMASS MODEL,
Rhode Island Univ., Kingston. Dept. of Civil and Environmental Engineering.
R. M. Wright, and A. J. McDonnell.
Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 5, P 967-982, October 1986. 7 fig, 5 tab, 19 ref.

Descriptors: *Macrophytes, *Streams, *Phosphorus removal, *Biomass models, Water quality, Eutrophication, Lakes, Rivers, Ecosystems, Phosphorus, Threshold levels, Aquatic plants, Wastewater treatment, Effluents, Periphyton, Nitrogen reserves, Oxygen models, Monitoring, Light intensity, Photosynthesis, Rooted aquatic plants, Nutrient removal.

An assessment was made of the water quality and the magnitude of growth of rooted aquatic macrophytes in a nutrient-enriched, shallow stream system (Spring Creek in central Pennsylvania) to provide a basis for evaluating the recovery of the ecosystem following the implementation of a program of phosphorus removal. Field investigations defined the temporal and spatial changes of plant biomass in selected study sections. A model to predict changes in macrophyte biomass as a function of varying environmental factors including nutrient flux was developed, calibrated and validated. The potential of the biomass model as a management tool to assess the impact of nutrient reductions on stream oxygen budgets was demonstrated. (See also W87-02887) (Author's abstract)
W87-02888

EFFECT OF ORGANOTINS ON FECAL POLLUTION INDICATOR ORGANISMS,
Massachusetts Univ. at Boston. Environmental Science Program.
G. W. Pettibone, and J. J. Cooney.
Applied and Environmental Microbiology AEMIDF, Vol. 52, No. 3, p 562-566, September 1986. 6 fig, 43 ref.

Descriptors: *Escherichia coli, *Streptococcus, *Organotin compounds, *Feces, *Bioindicators, Pollution, Estuaries, Water quality, Monitoring, Sublethal effects, Aquatic environment, Coliforms, Mortality, Temperature, Salinity, Enumeration, Heavy metals, Toxicity, Sediments.

Tributyltin was more toxic than either di - or trimethyltin to the indicator organisms, Escherichia coli or Streptococcus faecalis. This is consistent with reports that in general the most effective antibacterial organotins are di- and tri-substituted compounds which have a total of 6 to 15 carbon atoms. Although organotins are more effective against gram-positive than against gram-negative organisms, this was not true for two pure cultures of E coli and S faecalis. The cultures and environmental water samples were examined for the possibility that pollution involving organotin compounds could decrease the values of indicator organisms when standard methods were applied to the analysis of water samples. (CH3)2SnCl2 and (CH3)3SnCl decreased viable counts at about 10 to 100 mg Sn/l, and tributyltin chloride was effective at about 0.1 to 1.0 mg Sn/l. These concentrations, particularly for the methyltin compounds, are greater than the concentrations reported to date for these compounds in the aquatic environment. Thus, organotin compounds alone would not be likely to cause reductions in counts of indicator organisms measured by standard methods. However, it is suggested that, when combined with other environmental stressors or upon long exposure, organotins such as butyltins may contribute to the injury of indicator organisms. (Alexander-PTT)
W87-02901

DISTRIBUTION OF BENTHIC MACROINVERTEBRATES IN A STREAM EXPOSED TO URBAN RUNOFF,
New Jersey Dept. of Environmental Protection, Trenton. Office of Science and Research.
H. L. Garie, and A. McIntosh.
Water Resources Bulletin WARBAQ, Vol. 22, No. 3, p 447-456, June 1986. 5 fig, 3 tab, 29 ref.

Descriptors: *Benthic fauna, *Species diversity, *Stream pollution, *Urban runoff, *Bioindicators, Pollution, Heavy metals, Nonpoint source pollution, Artificial substrates, New Jersey, Shabakunk Creek, Mercer County.

A study of benthic macroinvertebrate community composition had been conducted at eight sites along Shabakunk Creek, a small stream in Mercer County, New Jersey, which received urban runoff. The relationship between changes in substrate composition and the nature of the benthic macroinvertebrate community had been examined. Organisms were collected seasonally from natural substrates in riffles. Number of total benthic macroinvertebrate taxa collected declined from 13 in relatively undeveloped upstream areas to four below heavily developed areas, while population density decreased simultaneously in the same areas. Periphyton samples collected from natural substrates were analyzed for selected heavy metals. Significantly higher heavy metal concentrations were reported from substrates sampled below heavily developed areas, and changes in these values have been discussed with regard to changes in benthic macroinvertebrate distribution. (Author's abstract)
W87-02939

PROBLEMS OF USING WASTEWATER ON VEGETABLE CROPS,
Kansas Agricultural Experiment Station, Manhattan. Evapotranspiration Lab.
For primary bibliographic entry see Field 3C.
W87-02954

MODELLING OF STRATIFIED FLOW AND EUTROPHICATION IN RESERVOIRS,
Central Research Inst. of Electric Power Industry, Tokyo (Japan). Civil Engineering Lab.
Y. Miyanaga.
Ecological Modelling, ECMODT Vol. 31, No. 1-4, p 133-144, May 1986. 6 fig, 6 tab, 18 ref.

Descriptors: *Population dynamics, *Eutrophication, *Reservoirs, *Numerical simulation models, *Thermal stratification, *Plankton, Massachusetts Insitute of Technology model, Mathematical models, DiToro model, Temperature, Dissolved oxygen, Orthophosphates, Chlorophyll a, Zooplankton, Biomass, Organic carbon, Equations,

Transparency, Japan, Pumped storage, Hydroelectric plants.

In order to simulate reservoir eutrophication, a numerical simulation model was developed that takes into account stratified flow and plankton dynamics in reservoirs. The model is based on the Massachusetts Institute of Technology's model for thermal stratification and DiToro and others' model for plankton dynamics. Assuming horizontal homogeneity at the stated variables (temperature, dissolved oxygen, orthophosphate, chlorophyll a, zooplankton biomass, and organic carbon), one-dimensional heat and mass balance equations were used to compute the vertical distribution of the variables. Transparency was also calculated, considering the light scattering by phytoplankton. The model was applied to reservoirs of a pumped-storage plant in Hyogo Prefecture, southern Japan, to assess its ability to reproduce biological and chemical phenomena. The result suggests that vertical mixing caused by the power plant operation has significant effects on the biological activities in the reservoirs. (Author's abstract)
W87-02968

ROOT CONTROL OF LEAF PHOSPHORUS AND CHLORINE ACCUMULATION IN SOYBEAN UNDER SALINITY STRESS,
Agricultural Research Service, Riverside, CA. Salinity Lab.
For primary bibliographic entry see Field 2I.
W87-02984

EFFECT OF METAL CHELATION ON THE TOXICITY OF SOME ENVIRONMENTALLY HAZARDOUS TRACE METALS TO DAPHNIA MAGNA,
Ecole Nationale Travaux Publics en l'Etat, Vaulx-en-Velin (France).
For primary bibliographic entry see Field 5G.
W87-03024

DECLINE OF THE GASTROPOD NUCELLA LAPILLUS AROUND SOUTH-WEST ENGLAND: EVIDENCE FOR THE EFFECT OF TRIBUTYLTIN FROM ANTIFOULING PAINTS,
Ben-Gurion Univ. of the Negev, Beersheba (Israel). Dept. of Biology.
G. W. Bryan, P. E. Gibbs, L. G. Hummerstone, and G. R. Burt.
Journal of the Marine Biological Association of the United Kingdom JMBAAK, Vol. 66, No. 3, p 611-640, August 1986. 11 fig, 5 tab, 40 ref. Dept. of the Environment (England) Contract DGR 480/51 and European Economic Community Contract ENV-686-UK(H).

Descriptors: *Common dogwhelk, *Nucella, *Tissue analysis, *Organotin compounds, *Bioindicators, *Water pollution effects, *England, *Imposex, *Antifouling paints, *Tributyl tin, Sex character induction, Helford Estuary, Fal Estuary, Salcombe Estuary, Dart Estuary, Plymouth Sound, Tor Bay, Mortality, Arsenic, Cadmium, Copper, Lead, Silver, Zinc, Marinas, Toxicity.

A survey of Nucella lapillus (common dogwhelk) around the south-west peninsula of England revealed that the incidence of 'imposex', the induction of male sex characters in the female, is widespread. Populations close to centers of boating and shipping activity show the highest degrees of imposex, especially those within the vicinities of the Helford, Fal, Salcombe, and Dart estuaries and in the Plymouth Sound and Tor Bay. Within Plymouth Sound the degree of imposex increased markedly between 1969 and 1985, coinciding with the introduction and increasing usage of antifouling paints containing tributyltin (TBT) compounds. The degree of imposex shows no correlation with the tissue burdens of As, Cd, Cu, Pb, Ag, or Zn, but increases with increasing concentrations of Sn. Transplantation of N. lapillus from a locality with little boating activity to a site close to a Plymouth marina caused a marked increase in the degree of imposex in the transplanted animals. Since the degree of imposex is easily measured and may be related to the mean levels of TBT compounds to which the populations are exposed, the species has great potential as an indicator of the extent of TBT contamination. (Rochester-PTT)
W87-03053

DROUGHT AND POWER PRODUCTION,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6D.
W87-03060

MODELLING THE EFFECTS OF ACIDIC DEPOSITION AND CONIFER AFFORESTATION ON STREAM ACIDITY IN THE BRITISH UPLANDS,
Institute of Hydrology, Wallingford (England).
C. Neal, P. Whitehead, R. Neala, and J. Cosby.
Journal of Hydrology JHYDA7, Vol. 86, No. 1/2, p 15-26, September 1986. 5 fig, 39 ref.

Descriptors: *Acid rain, *Acidic water, *England, *Reforestation, *Uplands, *MAGIC, Streamwater, Model studies, Simulations analysis, Catchment areas, Acid soils, Bedrock, Peat, Toxicity, Aluminum, Lakes, Streams, *Water pollution effects, Forestry.

Acid soils overlying massive base-poor bedrock occupy much of the British uplands. These soils, varying from peats, peaty gleys, peaty podzols, and podzols to rankers, are not only acidic but also are a potential source of environmentally toxic aluminum. Predictions of streamwater acidification using MAGIC model for the British uplands region sensitive to acidic deposition are presented. The modeling enables preliminary assessments to be made of some of the relative effects of atmospheric acidic oxide pollution and conifer afforestation, as well as highlighting some of the topics that need further consideration. For example, one simulation suggests that for present acidic oxide loadings, significant streamwater acidification can occur, irrespective of other complicating processes. The relationship between deposition and emissions is not necessarily linear, emission levels may need more substantial reductions. The study points to the need for further regional analysis of hydrogeochemical processes operating within catchments. Further, the study provides an example of the need to establish the extent of scavenging of aerosols onto plant surfaces, and more generally on the benefits of multidisciplinary catchment and modeling studies. While there is uncertainty regarding the nature and the extent of the hydrogeochemical processes operative, there is a need to change existing forestry practices which are of immediate pragmatic concern. (Lantz-PTT)
W87-03068

IMPACT OF CHEMICALLY CONTAMINATED SEWAGE SLUDGE ON THE COLLARD ARTHROPOD COMMUNITY,
Cornell Univ., Ithaca, NY.
T. W. Culliney, D. Pimentel, and D. J. Lisk.
Environmental Entomology, Vol. 15, No. 4, p 826-833, August 1986. 6 fig, 3 tab, 54 ref. EPA Grant R810790-01-0.

Descriptors: *Collards, *Arthropods, *Wastewater, *Sludge, *Land application, Manure, Contamination, Toxins, Dieldrin, Cadmium, Populations, Polychlorinated biphenyls, Plant pathology, Growth, Nutrients, Species diversity, Crop yield.

Stress effects on a terrestrial arthropod community were evident in a study of collards (Brassica oleracea L.) grown in soil amended with chemically contaminated sewage sludge. Plant growth was significantly reduced compared to growth in plots with relatively uncontaminated sludge or with manure. Population densities of major arthropod taxa tended to be lower in plots of contaminated sludge than in uncontaminated sludge or manure plots. Species richness and diversity were reduced on contaminated-sludge plots compared with the other two treatments. In general, few differences were seen in plant growth and arthropod numbers between the uncontaminated-sludge treatment or uncontaminated sludge treated with Cd or with dieldrin. Because the Cd and dieldrin were applied at the dosages of Cd and polychlorinated biphenyls found in the contaminated sludge, it appeared that these two toxins were not responsible for the effects observed in the contaminated-sludge treatment. Results of the present study indicate the potential of sludge-borne contaminants to suppress growth of crop plants and reduce the abundance of their associated arthropods. (Author's abstract)
W87-03081

ACUTE AND CHRONIC TOXICITY OF NICKEL TO LARVAE OF CHIRONOMUS RIPARIS (MEIGEN),
Polytechnic of Central London (England). Applied Ecology Research Group.
C. Powlesland, and J. George.
Environmental Pollution (Series A) EPEBD7, Vol. 42, p 47-64, 1986. 4 fig, 7 tab, 39 ref.

Descriptors: *Midges, *Water pollution effects, *Nickel, *Pollution tolerance, *Toxicity, *Larvae, *Heavy metals, Reproduction, Eggs, Chronic toxicity tests, Bioassay, Mortality, Hatching, Growth, Concentration.

The acute toxicity of Ni to first and second instars of Chironomus riparis was determined using larvae from a laboratory culture. First instar larvae were significantly more sensitive to Ni than second instars, with 48-hr LC50 values 79.5 + or - 3.7 mg/l Ni, and 169 + or - 10 mg/l, respectively. Thirty-day chronic toxicity tests, in which larvae were allowed to develop from eggs until just prior to pupation, indicated that Ni concentrations of up to 25 mg/l appeared to have little effect on the percentage hatch. The growth of larvae was, however, significantly reduced at the lowest Ni concentration tested (2.5 mg/l) compared with control larvae. A maximum acceptable toxic concentration for the effect of Ni on growth was estimated to be about 1.1 mg/l Ni. This value is substantially lower than the LC50 calculated for first instar larvae and indicates the importance of conducting longer-term toxicity tests when assessing the pollution tolerance of an organism. (Author's abstract)
W87-03083

EXPOSURE TO FLUORIDATED PUBLIC WATER SUPPLIES AND CHILD HEALTH AND BEHAVIOUR,
Christchurch Hospital (England). Christchurch Child Development Study.
F. T. Shannon, and L. J. Horwood.
New Zealand Medical Journal, Vol. 99, No. 803, p 416-418, 11 June 1986. 1 tab, 9 ref.

Descriptors: *Fluoridation, *Population exposure, *Public health, *Child health, *England, *Behavior, Socioeconomic background, Statistics, Christchurch.

The relationship between duration of exposure to fluoridated public water supplies and measures of child health and behavior was studied for a birth cohort of Christchurch (England) children. No association was found between exposure to fluoridated water and a large range of measures of child health and behavior taken during the period from birth to 7 yr, even when possible effects of family social background were accounted for statistically. (Author's abstract)
W87-03092

RESPONSE TO WATERLOGGING AND DIFFERING SENSITIVITY TO DIVALENT IRON AND MANGANESE IN CLONES OF DACTYLIS GLOMERATA L. DERIVED FROM WELL-DRAINED AND POORLY-DRAINED SOILS,
University Coll., Cardiff (Wales). Dept. of Plant Science.
J. R. Etherington, and O. M. Thomas.
Annals of Botany ANBOA4, Vol. 58, No. 1, p 109-119, July 1986. 1 fig, 6 tab, 26 ref.

Descriptors: *Cocksfoot grass, *Waterlogging, *Soil water, *Grazing, *Soil drainage, *Manganese, *Iron, Solution culture, Clonal propagation, Plant physiology, Plant tissue, Concentration, Leaves, Accumulation, Toxicity.

Clonally propagated plants of Dactylus glomerata (cocksfoot grass) derived from well-drained, heavily grazed cliff habitat (clone L) and from a poorly-drained, undergrazed soil (clone A) were tested for waterlogging tolerance in soil culture. Waterlogging did not affect the two clones differently, a result that contrasted strongly with a previous experiment involving simulated grazing. In solution culture, when provided with factorial combinations of 0.5 and 50 mg/cu dm Fe(2+) and Mn(2+), the shoot dry weight yield of clone L was reduced more than that of clone A by 50 mg Fe/cu dm irrespective of Mn(2+) concentration, but the reduction of growth was less at higher Mn(2+) concentrations. Mn(2+) at 50 mg/cu dm reduced the growth of clone L, but increased the growth of clone A plants with Fe(2+) at 5 mg/cu dm. Leaf tissue of clone L contained more Fe than that of clone A after waterlogging, but in solution culture, though increasing Fe from 0.5 to 50 mg/cu dm almost doubled leaf Fe content, the interaction Clones X Mn X Fe just failed to reach significance at $p < 0.05$. The Mn content of leaf tissue from the two clones varied differently in response to solution Mn, with clone A showing a slightly greater increase of Mn content at high solution concentration. Iron at 50 mg/cu dm suppressed Mn uptake in both clones. The two clones thus exhibited marked environmental adaptation to the chemistry of wet and dry soils. (Author's abstract)
W87-03095

EVALUATION OF EFFLUENT FROM GRASS SILAGE AS A FEED FOR BEEF CATTLE OFFERED SILAGE-BASED DIETS,
Agricultural Research Inst. of Northern Ireland, Hillsborough.
For primary bibliographic entry see Field 5E.
W87-03099

MANURIAL VALUE OF SEPTIC-TANK SLUDGE ON GRASSLAND,
Water Research Centre, Medmenham (England). Medmenham Lab.
For primary bibliographic entry see Field 5E.
W87-03102

GROWTH AND NUTRITIONAL STATUS OF PETUNIA AND TOMATO SEEDLINGS WITH ACIDIFIED IRRIGATION WATER,
Purdue Univ., Lafayette, IN. Dept. of Horticulture.
D. A. Bailey, and P. A. Hammer.
Hortscience HJHSAR, Vol. 21, No. 31, p 423-425, June 1986. 5 tab, 18 ref.

Descriptors: *Tomatoes, *Petunias, *Seedlings, *Plant growth, *Plant nutrition, *Irrigation, *Acid ice water, *Germination, Nitrogen, Phosphorus, Potassium, Calcium, Magnesium, Plant physiology, Tisue analysis.

Seed of Lycopersicon esculentum Mill. 'Champion' and Petunia hybrida Vilm. 'Snow Cloud' were irrigated with either nonacidified solution (0.15, 0.30, or 0.45 ml) of 75% H3PO4/l, or 0.11, 0.20, or 0.26 ml of 46.5% H2SO4/l. Germination was not affected by acidification, yet seedling growth was enhanced for both species. Growing medium and plant shoots were analyzed for N, P, K, Ca, and Mg content. Although nutrient levels were affected by acidification, no nutrient deficiency or phytotoxicity due to irrigation water acidification was evident. (Author's abstract)
W87-03105

IMPACTS FROM MOSQUITO CONTROL-INDUCED SULPHUR MOBILIZATION IN A CAPE COD ESTUARY,
National Park Service, Boston, MA. Office of Scientific Studies.
M. A. Soukup, and J. W. Portnoy.
Environmental Conservation EVCNA4, Vol. 13, No. 1, p 47-50, Spring 1986. 2 fig, 18 ref.

Descriptors: *Estuarine environment, *Mosquitoes, *Sulfur cycle, *Drainage effects, *Cape Cod, Dikes, Drainage programs, Pyrite, Oxidation, Acidic water, Leachates, Hydrogen ion concentration, Aluminum, Aquatic environment, Toxicity, Alewife, Eel, Sediments.

The diking and drainage practices at a Cape Cod estuary were evaluated with respect to their effectiveness in controlling mosquitoes and their impact on aquatic fauna. The primary effect was the mobilization of sulfur from pyrite oxidation which caused desiccated saltwater sediments to produce acidified leachates. Lower pH resulted and acid-mobilized aluminum concentrations exceeded toxic levels. Fish populations, including American eel and alewife, were decimated while acid tolerating mosquitoes continued to thrive. The use of this method for mosquito control should be reevaluated in terms of both its effectiveness and impact on the aquatic environment. (Michael-PTT)
W87-03127

MICROBIAL ASPECTS OF WASTEWATER REUSE FOR IRRIGATION,
Arizona Univ., Tucson. Dept. of Microbiology and Immunology.
For primary bibliographic entry see Field 3C.
W87-03129

MIXED-CULTURE MICROBIAL PROTEIN FROM WASTE SULFITE PULPING LIQUOR II: ITS PRODUCTION ON A PILOT-PLANT SCALE AND USE IN ANIMAL FEED,
Quebec Univ., Trois-Rivieres. Centre de Recherche en Pates et Papiers.
For primary bibliographic entry see Field 5E.
W87-03132

AMMONIUM (15N) METABOLISM IN COTTON UNDER SALT STRESS,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
M. Pessarakli, and T. C. Tucker.
Journal of Plant Nutrition JPNUDS, Vol. 8, No. 11, p 1025-1045, November 1985. 2 tab, 15 ref.

Descriptors: *Cotton, *Salt stress, *Ammonium metabolism, *Nitrogen-15, *Plant growth, *Plant water potential, *Proteins, Tissue analysis, Plant physiology, Hoagland medium, Salinity, Osmotic pressure, Protein synthesis, Radioactive tracers, Nutrients, Ions.

The effects of NaCl stress on NH4(+) metabolism in cotton (Gossypium hirsutum L.) plants were investigated at vegetative and reproductive stages of growth. Plants grown in normal (control) and NaCl-treated Hoagland solutions were analyzed for distribution of N-15 in NH4(+) plus amide N, free alpha-amino N, total soluble N, and protein N after the plants were provided with 15NH4NO3 in nutrient solutions for 6, 12, and 24 hr. The concentration of protein N was enhanced under a low level of NaCl (-0.4 MPa osmotic potential) at the vegetative growth stage. The difference between the protein N concentration of the moderately salinized (-0.8 MPa) plants and the controls was not significant. A high level of NaC (-1.2 MPa) significantly decreased protein N content of plants compared with the controls and any other level of salinity. The NaCl increased accumulation of NH4(+) plus amide N, free alpha-amino N, and total soluble N in cotton shoots, at both stages of growth. Low osmotic potential (high osmotic pressure) of the nutrient solution induced by excessive amounts of NaCl in nutrient solution inhibited NH4(+) metabolism and decreased protein synthesis, thus resulting in accumulation of soluble N compounds. The ionic effect probably contributed also to inhbitiion of protein synthesis. (Author's abstract)
W87-03151

BORON TOLERANCE AND ACCUMULATION IN THE DUCKWEED, LEMNA MINOR,
Delaware Univ., Newark. Dept. of Plant Science.
H. Frick.
Journal of Plant Nutrition JPNUDS, Vol. 8, No. 12, p 1123-1129, December 1985. 4 tab, 17 ref.

Descriptors: *Duckweed, *Boron, *Water pollution effects, *Toxicity, *Plant growth, *Hydrogen ion cocnentration, Aquatic plants, Accumulation, Plant physiology, Culture media.

A sensitive measure of growth in duckweed was used to demonstrate the tolerance of this higher plant to boron (B(OH)3) at levels of 10 to 20 microgram (ug)/ml in the growth medium at pH 5.0. Growth inhibition by B in concentrations up to 100 ug/ml in the external medium was reversible after transfer to control medium. At pH 4.0 and in the presence of 20 ug/ml B for 7 days, the plants accumulated 93 ug B/g fresh weight (148% of the control) and this increased with pH up to pH 7.0 where the plants accumulated 257 ug B/g fresh weight (525% of the control). Only at pH 7.0 in the presence of B was growth inhibited. Thus, plants that had accumulated more than 100 ug B/g fresh weight still grew normally. This corresponds to about 800 ug B/g dry weight accumulated without an effect upon growth rate. (See also W87-03153) (Author's abstract)
W87-03152

MICRONUTRIENT TOLERANCE AND ACCUMULATION IN THE DUCKWEED, LEMNA,
Delaware Univ., Newark. Dept. of Plant Science.
H. Frick.
Journal of Plant Nutrition JPNUDS, Vol. 8, No. 12, p 1131-1145, December 1985. 1 fig, 3 tab, 23 ref.

Descriptors: *Duckweed, *Iron, *Heavy metals, *Water pollution effects, *Manganese, *Boron, *Copper, *Accumulation, *Molybdenum, *Toxicity, Zinc, Micronutients, Plant growth, Plant physiology, Plant pathology, Aquatic plants, Interactions, Accumulation, Culture media.

Vegetative growth of the aquatic monocot Lemna minor L. (duckweed) under continuous irradiation in photoheterotrophic medium is log-linear, with a frond doubling time of about 1.4 days. This steady-state frond multiplication rate was not altered by concentrations of micronutrients (Fe, Mn, B, Cu, Zn, Mo) between 28 and 1000 times that contained in the usual growth medium. Using high, but non-inhibitory, concentrations, the effect on steady-state growth of all possible 2-, 3-, 4-, 5-, and 6-way combinations was studied. Lemna growing in the presence of high concentrations of any other micronutrient was least tolerant to the addition of Mo. Growth inhibition due to 2-way combinations of certain elements (e.g., Mn, Mo) was prevented by the presence of a third (e.g., Mn, Mo, Zn) in patterns suggesting selective interactions among the elements. Moreover, in the absence of Mo in high concentration, the combination of the other 5 micronutrients was not inhibitory even though separate 2-, 3-, and 4-way combinations were. The accumulation of micronutrients during steady-state growth showed that each was absorbed against a chemical gradient at high external concentration (no data for B). In the absence of growth inhibition, Fe accumulated to 65 microgram (ug)/g fresh weight, Mn to 221, Cu, to 40, Zn to 139, and Mo to 705. (See also W87-03152) (Author's abstract)
W87-03153

RESPONSES OF LETTUCE TO SALINITY. I. EFFECTS OF NACL AND NA2SO4 ON GROWTH,
California Univ., Davis. Dept. of Vegetable Crops.
G. R. Cramer, and A. R. Spurr.
Journal of Plant Nutrition JPNUDS, Vol. 9, No. 2, p 115-130, February 1986. 7 fig, 23 ref.

Descriptors: *Lettuce, *Salinity, *Salt stress, *Hydroponics, *Sodium chloride, *Sodium sulfate, Hoagland medium, Plant growth, Salt tolerance, Cultivar comparison, Plant physiology, Plant water relations, Nutrients, Ions.

Two lettuce (Lactuca sativa L.) cultivars, Calmar and Climax, were selected to compare their tolerance to salt stress. The plants were grown in a hydroponic system using a 0.5 modified Hoagland solution. Treatments of 0, 40, 80, and 120 moles/cu m NaCl or 0 and 20 moles/cu m Na2SO4 were started when the second leaf above the cotyledons appeared. The plants were harvested 20 days later.

Climax showed a greater tolerance to salinity at the 40 moles/cu m NaCl concentration; the percentage decrease in both shoot and root fresh weight was significantly less than Calmar. No differences between the cultivars were found in the Na2SO4 experiments. Differences in root Cl(-) content at the 40 mol/cu m concentration corresponded to an enhanced water content of the roots. A mechanism for the observed differences in salt tolerance between the two cultivars is discussed. (See also W87-03154) (Author's abstract)
W87-03154

SALT RESPONSES OF LETTUCE TO SALINITY. II. EFFECT OF CALCIUM ON GROWTH AND MINERAL STATUS,
California Univ., Davis. Dept. of Vegetable Crops.
G. R. Cramer, and A. R. Spurr.
Journal of Plant Nutrition JPNUDS, Vol. 9, No. 2, p 131-142, February 1986. 6 fig, 10 ref.

Descriptors: *Calcium, *Salt tolerance, *Lettuce, *Plant growth, *Potassium, Tissue analysis, Plant physiology, Salinity, Sodium chloride, Calcium sulfate, Plant nutrition, Hoagland medium, Plant water relations, Sodium-calcium ratio, Cultivar comparison, Ions, Nutrients, Transport.

The effect of Ca(2+) on the salt tolerance of the lettuce (Lactuca sativa L.) cultivars Calmar and Climax, which differ in their salt tolerance, was studied. The plants were grown in a 0.5 modified Hoagland solution. Treatments of NaCl or NaCl + CaSO4 (final Na(+):Ca(2+) ratio approximately 7:1 on a moles/cu m basis) were added to the nutrient solution when the second leaf above the cotyledons appeared. The plants were harvested 20 days after the treatment began. Plant growth was reduced by salinity (0 to 120 moles/cu m NaCl), but addition of supplemental Ca(2+) did not affect salt tolerance. The mineral status of the plant, however, was affected by the Ca(2+) treatments. The Ca concentrations in both root and shoot, and the Mg concentrations in the shoot, were higher than those in the low Ca(2+) treatment. High external Ca(2+) treatments did not affect Cl(-) tissue concentration, nor shoot or root growth. The effect of high Ca(2+) concentration K tissue concentrations remained equivocal. The differential responses of these elements to high Ca(2+) suggested that selective ion transport was affected by salinity and Ca(2+) treatments. (see also W87-03154) (Author's abstract)
W87-03155

CONTRASTING RESPONSE TO SALT STRESS OF TWO SALINITY TOLERANT CREEPING BENTGRASS CLONES,
California Univ., Davis. Dept. of Environmental Horticulture.
R. Chetelat, and L. Wu.
Journal of Plant Nutrition JPNUDS, Vol. 9, No. 9, p 1185-1197, September 1986. 1 fig, 2 tab, 16 ref. Elvenia J. Slosson Endowment Fund Ca-D*-EHT-4063-H.

Descriptors: *Creeping bentgrass, *Salt tolerance, *Salt stress, *Plant growth, *Ion transport, Plant physiology, Beaches, Oregon, Clones, Dry weight partitioning, Plant morphology, Sodium, Potassium, Chlorides, Tissue analysis.

Two creeping bentgrass clones having contrasting salinity tolerances, which were collected from a salinity-tolerant beach site population in Seaside, Oregon, were examined for growth responses and ion uptake under NaCl-stressed conditions. The two clones showed differences in dry weight partitioning and morphology in response to salt stress. The clone with the greater salt tolerance had greater ion partitioning differences in Na, Na/K, and Cl levels between organ tissues. (Author's abstract)
W87-03156

FORMS OF NITROGEN IN WATERLOGGED SOILS AND THEIR CONTRIBUTION TO YIELD AND NITROGEN UPTAKE BY RICE,
Rajendra Agricultural Univ., Samastipur (India). Dept. of Soil Science and Agricultural Chemistry.
For primary bibliographic entry see Field 3C.
W87-03158

NONPOINT SOURCE LOADING OF PHENOLIC ACIDS FROM DECOMPOSING CROP RESIDUE,
Maryland Univ., College Park. Dept. of Agronomy.
For primary bibliographic entry see Field 5B.
W87-03161

EFFECTS OF SULPHIDE ON SURVIVAL OF AERO-AQUATIC AND AQUATIC HYPHOMYCETES,
Exeter Univ. (England). Dept. of Biological Sciences.
J. I. Field, and J. Webster.
Transactions of the British Mycological Society BMSTA6, Vol. 85, No. 2, p 193-199, September 1985. 2 tab, 24 ref.

Descriptors: *Sulfides, *Aero-aquatic fungi, *Aquatic hyphomycetes, *Efford Lake, River Erme, Sequer's Bog, England, Beech leaf disks, Hydrogen ion concentration, Growth, Seasonal variation, Drying, *Survival, Plant physiology.

Sulfide concentrations were measured at the mud surface in Efford Lake, a small brackish pond, which is flooded by tidal water of the River Erme, and Sequer's Bog, which receives water from surrounding fields and woodland and usually dries out in summer, and the River Erme (all in England), in which aero-aquatic fungi grow. Studies on the survival of aero-aquatic and aquatic hyphomycetes on beech leaf disks under anaerobic conditions and subjected to sulfide concentrations ranging from 5-20 mg/l at pH 4 and pH 7 for 24 hr indicated that the latter were more sensitive to sulfide concentration. (Rochester-PTT)
W87-03174

WATER OR SALT STRESS INCREASES INFECTIVITY OF ERYSIPHE PISI CONIDIA TAKEN FROM STRESSED PLANTS,
Lancaster Univ., Bailrigg (England). Dept. of Biological Sciences.
L. E. Wyness, and P. G. Ayres.
Transactions of the British Mycological Society BMSTA6, Vol. 85, No. 3, p 471-476, October 1985. 2 fig, 1 tab, 24 ref.

Descriptors: *Conidia, *Powdery mildew, *Pea plants, *Water stress, *Salt stress, *Germination, *Plant water relations, *Elongating secondary hyphae, *Infectivity, Plant physiology, Plant pathology, Polycyclic epidemics, Soil fungi, Appressoria.

Conidia of Erysiphe p'si (powdery mildew of pea) were taken from pea plants (donors) subjected either to water stress by withholding water from the soil or to salt stress by addition of NaCl solutions to the soil, or from unstressed control plants, and were inoculated onto the leaves of similarly stressed or control plants (recipients). Conidia from controls completed germination by 8 hr and elongating secondary hyphae (ESH) formation by 24 hr after inoculation, but conidia from stressed plants continued their development up to 48 hr (end of observation). Conidia from water-stressed plants had germinated more by the end of the experiment than conidia from control donors, but conidia from salt-stressed donors had only reached the same levels as those of the controls. Neither water nor salt stress in donors or recipients affected the formation of appressoria by germinated spores. Both water and salt stress of donors significantly stimulated ESH formation from germinated conidia. The only signficant effect of stress on recipients was that salt stress stimulated the germination of conidia. Slight changes in infectivity induced by stress may have a considerable cumulative effect over several generations of a polycyclic epidemic in the field. (Rochester-PTT)
W87-03175

TEST OF A PROPOSED ORGANIZATIONAL FRAMEWORK FOR THE ORDERING OF ALGAL TOXICITY RESPONSES,
Herbert H. Lehman Coll., Bronx, NY. Dept. of Biological Sciences.
B. E. Warkentine, and J. W. Rachlin.
Torrey Botanical Club Bulletin, Vol. 113, No. 1, p 12-15, January-March, 1986. 2 tab, 19 ref. PSC-CUNY Grant Nos. 6-64141 and 6-65144.

Descriptors: *Toxicity, *Algae, *Bioindicators, Water pollution effects, Chlorella saccharophila, Navicula incerta, Nitzschia closterium, Cadmium, Phytotoxicity.

In 1982, an organization framework for the ordering of algal toxicity responses was proposed. This framework assumed that physiological responses were, in fact, character states, and therefore could be ordered by linking these responses to the organismic relationships deduced through the methodology of phylogenetic systematics. That is, closely related species should respond to environmental stress in a similar fashion. The original test was based on growing and testing organisms under optimal conditions. If the proposed framework is to have utility, it must also operate under less than optimal conditions. This study tested this notion. Three algal species Chlorella saccharophila, Navicula incerta, and Nitzschia closterium were cultured under identical and non-optimal growth conditions and then challenged with the metal toxicant cadmium for 96 hours under static conditions. Logarithmic response curves for the test cadmium concentrations were generated, and the respective alopes were found to -1.27, -1.65, and -1.57. Analysis of covariance indicated no significant difference in the response rates of the two diatoms Navicula and Nitzschia but each was significantly different from the response rate of the chlorophyte Chlorella. These results are consistent with the framework's prediction that organisms more closely related to each other will respond to environmental stress in a more consistent fashion than either will when compared to less closely related taxa; this, regardless of whether they are grown under optimal conditions or not. Hence, the proposed organizational framework holds and has predictive value. (Author's abstract)
W87-03205

RATES OF MINERAL ELEMENT LEACHING FROM LEAVES OF NINE PLANT SPECIES FROM A SOUTHERN APPALACHIAN FOREST SUCCESSION SUBJECTED TO SIMULATED ACID RAIN,
Georgia Univ., Athens. Dept. of Botany.
B. Haines, J. Chapman, and C. D. Monk.
Torrey Botanical Club Bulletin, Vol. 112, No. 3, p 258-264, July-September, 1985. 2 tab, 343 ref. EPA Grant No. R80530510, and NSF Grant Nos. DEB7619930, DEB7705324A01, and DEB7904537.

Descriptors: *Acid rain, *Water pollution effects, *Simulated rainfall, *Leaching, *Forests, Herbs, Erechtites hieracifolia, Erigeron canadensis, Pinus strobus, Robinia pseudo-acacia, Hydrogen ion concentration, Nitrogen, Nitrates, Nitrites, Potassium, Calcium, Magnesium, Phosphorus, Simulated rainfall.

Rates of mineral element leaching from plants subjected to simulated acid rain were determined for plants from a forest succession. Early successional plants were the herbs Erechtites hieracifolia and Erigeron canadensis and the early successional shrub-tree was Robinia psuedo-acacia. Later successional species were pinus strobus, Carya illinoensis, Limodendron tulipifera, Quercus prinus, Acer rubrum and Cornus florida. Simulated rain consisted of deionized water plus a salt and an acid component to produce pH values of 5.5, 4.5, 3.5 and 2.5. Solutions were applied through a raindrop simulator at 0.9 cm/hr for 10 periods of 1 hr each. Leachate from the leaves was collected and analyzed for NH4-N, NO3-N, K, Ca, Mg, and P. Rates of leaching ranged from 0.0006 to 11.3 mg of element/10 d sq m/hr. There were highly significant differences in leaching rates among species but no significant differences among pH treatments for the elements analyzed. Highest leaching rates occurred in Erechtites and Erigeron. The absence of a pH effect on leaching rates is consistent with

the absence of evidence of acid rain damage to the leaves of the plants tested. (Author's abstract)
W87-03206

OPERATION OF SELECTIVE WITHDRAWAL FACILITIES: LIBBY DAM, MONTANA,
Corps of Engineers, Seattle, WA. Seattle District.
J. W. Helms.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 35-41, 7 ref.

Descriptors: *Water quality control, *Selective withdrawal, *Libby dam, *Montana, *Reservoir operation, *Kootenai River, Nutrients, Eutrophication, Dissolved oxygen, Hydrogen sulfide, Reservoir design, Impoundments, Temperature.

During the late construction phase of the Libby Dam Project, located on the Kootenai River in Northwestern Montana, concerns were expressed over the effects of high nutrient loads upon the impoundment and downstream releases. Forecast methods indicated that growth and decay of algal blooms might create periods when the dissolved oxygen in the lower reservoir levels were depleted. Releases from these levels might be detrimental to downstream fisheries either through the absence of dissolved oxygen or the presence of hydrogen sulfide. Also, release temperatures from low reservoir levels would be too cold to promote a productive downstream fishery. To alleviate these problems, release structures at the dam were modified to permit a selective withdrawal of reservoir water. Slotted tracks with baffles stacked one-on-top-of-another are used to control withdrawal of water from selected levels in the reservoir throughout nearly the entire depth of active storage. Subsequent studies, after impoundment, allayed fears of eutrophication effects and selective withdrawal operation has been directed toward enhancement of downstream fisheries via temperature modification. This mode of operation which has resulted in a significant improvement of the Kootenai River fishery will be discussed. (See also W87-03221) (Author's abstract)
W87-03227

WATER QUALITY OUTLET WARM SPRINGS DAM,
Corps of Engineers, Omaha, NE.
For primary bibliographic entry see Field 5G.
W87-03232

DETERMINATION OF SELECTIVE WITHDRAWAL SYSTEM CAPACITY FOR INTAKE TOWER DESIGN,
Corps of Engineers, Baltimore, MD. Baltimore District.
For primary bibliographic entry see Field 5G.
W87-03234

SELECT: THE NUMERICAL MODEL,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 5G.
W87-03235

BLENDING IN A SINGLE WET WELL,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 5G.
W87-03236

OPERATIONAL TOOLS: OPTIMAL CONTROL OF RESERVOIR WATER QUALITY,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 5G.
W87-03239

SELECTIVE WITHDRAWAL NEEDS FOR LAKE GREESON ARKANSAS INTAKE STRUCTURE,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
For primary bibliographic entry see Field 5G.
W87-03242

ECOLOGICAL EVALUATION OF ORGANOTIN-CONTAMINATED SEDIMENT,
Naval Ocean Systems Center, San Diego, CA. Environmental Sciences Div.
For primary bibliographic entry see Field 5B.
W87-03254

CHARACTERIZATION OF SEDIMENT CONTAMINATION UTILIZING BIOASSAY/BIACCUMULATION TESTING,
Corps of Engineers, New York. New York District.
For primary bibliographic entry see Field 5B.
W87-03255

INFLUENCE OF ACCUMULATING ORGANIC SEDIMENT ON THE MARINE ENVIRONMENT IN OSAKA BAY,
Ministry of Transport, Kobe (Japan). 3rd District Port Construction Bureau.
M. Kawaguchi, T. Saski, and H. Noguchi.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 186-210, 22 fig.

Descriptors: *Organic compounds, *Sediment contamination, *Water pollution, *Marine environment, *Osaka Bay, Japan, Estuaries, Bays, Phosphorus, Nitrogen, Eutrophication, Water quality, Water pollution effects, Fate of pollutants.

Water quality in Osaka Bay has been deteriorating due to an inflow of contaminants discharged from industrial sites along the coast since the rapid economic growth period of the 1960s. Particularly, in the offshore bay area (bay head) where the tidal flow is stagnant, eutrophic pollution is progressing. The accumulating organic sediments which release phosphorus and nitrogen are accelerating the eutrophication of the water. Since 1979, a variety of investigations have been conducted by the 3rd District Port Construction Bureau of the Ministry of Transport to probe measures for improving the offshore sea environment. The main conclusions are: (1) Pollution of the bottom sediment in Osaka Bay is serious in the offshore bay area; (2) There is a positive relationship between the areas of polluted bottom sediment and the areas of degenerated quality of the bottom water layer; (3) Nutrient release is prominent in the offshore bay area; (4) Contaminant release occurs in the uppermost 50-cm layer of the bottom sediment. Consequently, removal of this layer will eliminate the release phenomenon; and (5) The clarification method of the bottom sediment in Osaka Bay that can meet the social demand is the dredging-beach nourishment method. (See also W87-03248) (Lantz-PTT)
W87-03257

PRINCIPLES AND PRACTICES FOR THE OCEAN DISPOSAL OF DREDGED MATERIAL: THE LONDON DUMPING CONVENTION RE-EXAMINED,
New Orleans Board of Commissioners of the Port, LA.
For primary bibliographic entry see Field 5E.
W87-03267

MUSSEL WATCH PROGRAM/MONITORING THE LONG-TERM EFFECTS OF DREDGED MATERIAL DISPOSAL IN NEW ENGLAND WATERS,
Corps of Engineers, Waltham, MA. New England Div.
For primary bibliographic entry see Field 5B.
W87-03270

DISSOLVED LOADS OF RIVERS AND SURFACE WATER QUANTITY/QUALITY RELATIONSHIPS.
International Association of Hydrological Sciences.
For primary bibliographic entry see Field 5B.
W87-03272

BUDGET OF WATER AND ITS CONSTITUENTS FOR LAKE TAUPO (NEW ZEALAND),
Utrecht Rijksuniversiteit (Netherlands). Dept. of Geography.
For primary bibliographic entry see Field 2H.
W87-03295

HEAVY METAL CONTENT IN SEDIMENTS OF LAKES IN SOUTHERN BAVARIA AS A SIGN OF LONG-TERM ENVIRONMENTAL IMPACT,
Munich Univ. (Germany, F.R.). Geographische Inst.
G. Michler.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 405-419, 10 fig, 2 tab, 16 ref.

Descriptors: *Heavy metals, *Lake sediments, *Bavaria, Environmental effects, History, Cores, Chemical analysis, Zinc, Lead, Cadmium, Effluents, Sewage.

The great age of lake sediment permits as reasonable estimation of the extent, distribution and origin of heavy metal contamination caused by man. Cores have been analyzed from 25 lakes in southern Bavaria and reflect the history of sedimentation over periods of up to 15,000 years. The first signs of change in profiles of heavy metal concentrations mostly occur at a depth of 0.5 to 2.0 m below the sediment surface, are generally dated as thirteenth century, and are associated with large-scale deforestation. Increases in zinc associated with the mining and the use of coal start after the eighteenth century, whereas definite increases in lead and cadmium are apparent after the beginning of the twentieth century and two to three decades later, respectively. Although heavy metal concentrations in most lake sediments have not reached toxic levels, the impact of heavy metal pollution has been very strong over the last 1500 years and has even caused contamination in lakes remote from centers of population and industry. The increase in heavy metal concentrations has been most alarming for artificial lakes, such as the 'Speichersee', which is affected by sewage effluent from Munich. The information provided by the cores on bioproduction and palaeoclimatic and palaeolimnic conditions is also discussed. (See also W87-03272) (Author's abstract)
W87-03305

EFFECTIVENESS OF CAPPING IN ISOLATING DUTCH KILLS SEDIMENT FROM BIOTA AND THE OVERLYING WATER,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5G.
W87-03332

ACID RAIN: A REVIEW OF THE PHENOMENON IN THE EEC AND EUROPE.
Commission of the European Communities, Luxembourg.
Unipub, New York, New Yor, 1983. 159 p.

Descriptors: *Acid rain, *Path of pollutants, *European Economic Community, *Environmental effects, *Water pollution effects, *Lakes, *Water pollution sources, Norway, Sweden, England, Scotland, Wales, Germany, Forests, Sulfur dioxide, Sulfuric acid, Ozone, Nitric acid, Fish, Cost analysis, Water pollution control, Air pollution.

The report examines the extent of environmental damage in the European Economic Community and in certain other European countries that may be attributable to acid pollutant emissions within Member States. The study assesses the evidence for possible causal effects and considers the physi-

cal, chemical and biological processes which have been suggested as damage mechanisms. Concern in Europe has grown in the past few years as a result of observed damage to forests found principally in central and southern Germany, and also because of the loss of fish populations in the lakes of parts of southwest Norway and Sweden. More recently, a few lakes, rivers and streams in Scotland, England and Wales, with geological and upper river catchments similar in character to those areas of Scandinavia referred to, have also reported absence or death of fish. Historically, most attention has focused on SO2, and its oxidized 'wet' form, sulfuric acid. Overall emissions of SO2 in the Community have declined in the last ten years and this trend may well continue. Without further abatement measures, this decline is not likely to be more than 15% by 2000. Recent investigations in Europe and work in the USA suggest that NOx emissions, which arise from both stationary and vehicle fossil fuel combustion, and which are on a rising trend, may also contribute significantly to plant and tree damage. In particular ozone, of which NOx is a chemical precursor, can, at certain concentrations under summer climate conditions, cause damage or yield effects to some trees and plants, possibly in conjunction with SO2 and NOx. the costs of SO2 and NOx emissions control are considerable. In considering any future control strategies, it should be recognized that the relative costs and benefits certainly vary from one Member State to another, and that, for some countries, transboundary effects are probably also a significant factor. (Lantz-PTT)
W87-03338

5D. Waste Treatment Processes

EFFECT OF SEAWATER ON NITRIFICATION BY ATTACHED BIOFILM,

Tohoku Univ., Sendai (Japan). Dept. of Civil Engineering.
S. Kawasaki, M. J. Gromiec, K. Hanaki, and J. Matsumoto.
Ecological Modelling, Vol. 32, No. 1-3, p 183-190, June 1986. 3 fig, 3 tab, 8 ref.

Descriptors: *Continuously stirred tank reactors, *Nitrification, *Biofilm, *Wastewater treatment, *Activated sludge, *Biological wastewater treatment, *Seawater, Nitrates, Ammonium, Bacterial physiology, Bench-scale studies, Mixed cultures.

Bench-scale, continuously stirred tank reactors were used to study the effect of seawater on nitrification by a mixed culture biofilm originating from activated sludge. The strength of the seawater was increased gradually so that the biofilm became acclimatized to seawater. At a seawater strength of up to 50%, the nitrite production rate increased with increase in seawater strength, rapidly from 0-10% seawater and more slowly after that. At a seawater strength of 0-10%, the nitrate production rate increased with the increase of seawater strength. The maximal value of nitrate production was observed at about 10% seawater, with a decrease thereafter to little production at 50% seawater. At seawater strength of 0-10%, the numbers of bacteria (ammonium oxidizing and nitrite oxidizing) were almost constant, indicating that increases in nitrate and nitrite production rates were due to increases in per-cell production. At a seawater strength over 10%, bacterial numbers increased exponentially with an increase in seawater strength. (Rochester-PTT)
W87-02603

EFFECT OF INFLUENT PHOSPHORUS REDUCTIONS ON GREAT LAKES SEWAGE TREATMENT COSTS,

Wisconsin State Lab. of Hygiene, Madison.
W. C. Sonzogni, and T. M. Heidtke.
Water Resources Bulletin WATBAQ, Vol. 22, No. 4, p 623-627, August 1986. 3 tab, 24 ref.

Descriptors: *Cost analysis, *Wastewater treatment, *Influent water, *Phosphorus removal, Great Lakes, Raw wastewater, Economic evaluation, Economic justification.

The potential cost savings of phosphorus limitation in raw wastewater is examined. Based on experience in the Great Lakes, the impact of reducing phosphorus content of influent wastewater on the cost of chemical phosphorus removal programs at wastewater treatment plants is evaluated. A range of cost savings is identified that results from a decrease in the amount of chemicals required for phosphorus removal as well as a decrease in sludge production. Total annual savings are projected for the Great Lakes basin. These estimates may be applicable to other areas where phosphorus controls are being proposed. (Michael-PTT)
W87-02630

FINDING USES FOR SLUDGE,

Brown and Caldwell, Pleasant Hill, CA.
For primary bibliographic entry see Field 5E.
W87-02641

VIRUS REMOVAL BY ACTIVATED SLUDGE TREATMENT,

Kitakyushu Municipal Inst. of Environmental Health Sciences (Japan).
E. Shimohara, S. Sugishima, and M. Kaneko.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 153-158, October 1985. 5 fig, 5 ref.

Descriptors: *Wastewater treatment, *Performance evaluation, *Disinfection, *Activated sludge process, *Viruses, Sludge, Activated sludge, Biological wastewater treatment.

Removal of poliovirus 1 by activated sludge treatment was investigated in batch experiments. Virus counts were reduced by more than 99% under conditions of 0.2 to 0.4 kg BOD/kg MLSS per day and MLSS concentrations of 1,000 to 2,000 mg/l. There were no distinct relationships between BOD-SS loadings or TOC of the effluent and virus inactivation rates. MLSS levels of more than 800 mg/l were required for more than 99% reduction in viral counts. Although MLSS levels of more than 2,000 mg/l reduced viral counts by 4 log values, factors such as low temperatures and anaerobic conditions which adversely affect the efficiency of activated sludge processes resulted in prolonged virus survival. (Author's abstract)
W87-02658

DETECTION OF INDIGENOUS ENTERIC VIRUSES IN RAW SEWAGE EFFLUENTS OF THE CITY OF ATHENS, GREECE, DURING A TWO YEAR SURVEY,

Institut Pasteur Hellenique, Athens (Greece). Dept. of Virology.
For primary bibliographic entry see Field 5B.
W87-02659

BACTERIA AND VIRUSES IN AEROBICALLY DIGESTED SLUDGE: INFLUENCE OF PHYSICAL AND CHEMICAL TREATMENTS ON SURVIVAL AND ASSOCIATION WITH FLOCS UNDER LABORATORY CONDITIONS,

Florida Univ., Gainesville. Dept. of Microbiology and Cell Science.
S. R. Farrah, P. R. Scheuerman, R. D. Eubanks, and G. Bitton.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 165-174, October 1985. 1 fig, 5 tab, 15 ref. EPA Grant R806290.

Descriptors: *Bacteria, *Viruses, *Aerobic digestion, *Sludge, *Wastewater treatment, *Physicochemical treatment, *Survival, *Flocculation, Digestion, Indicators, Bioindicators, Wastewater treatment, Water treatment, Adsorption, Sludge digestion, Pathogenic bacteria, Protozoa.

The effect of chemical (NaF, NaN3) and physical (heating, autoclaving) treatments of sludge flocs on bacteria and viruses in sludge undergoing aerobic digestion was investigated as part of studies on the mechanisms of removal of these agents by aerobic waste treatment. Following either chemical or physical treatments, aerobically digested sludge flocs adsorbed only a small portion of added or indigenous bacteria. These treatments also reduced inactivation of bacteria as compared with untreated sludge flocs. However, they had relatively little effect on either adsorption of enteroviruses to sludge flocs or on inactivation of viruses. The treatments that decreased bacterial association with sludge flocs and decreased the inactivation rate of bacteria also reduced the number of active protozoans and other predators. It is concluded that enteric viruses and bacteria have different affinities for sludge flocs and are inactivated by different mechanisms during aerobic digestion of sludge. (Author's abstract)
W87-02660

VIRUS INACTIVATING EFFECT OF ANAEROBIC MESOPHILIC DIGESTION OF MUNICIPAL SLUDGE WITH OR WITHOUT DIFFERENT PRECEDING TYPES OF TREATMENT,

Hohenheim Univ., Stuttgart (Germany, F.R.). Inst. fuer Tiermedizin und Tierhygiene.
J. Wekerle, M. Leuze, and K. Koch.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 175-184, October 1985. 1 fig, 8 tab, 18 ref.

Descriptors: *Viruses, *Wastewater treatment, *Anaerobic digestion, *Municipal wastewater, *Sludge digestion, *Performance evaluation, Digestion, Wastewater, Biodegradation, Enteroviruses, Sludge, Wastewater treatment, Public health, Pilot plants.

The effect of the conventional mesophilic anaerobic one-step digestion, and of two-phase processes with and without prepasteurization and pasteurization of the digested sludge was investigated on three non-enveloped viruses. Reovirus Type 1 and bovine Enterovirus (ECBO-LCR-4) were inactivated completely by the one-step mesophilic anaerobic digestion process with a mean hydraulic retention time (MHRT) of 20 days, as well as by the two-phase process with a MHRT of two days in the anaerobic pretreatment at 33 C or 20 C and eight days in the main digestion at 33 C, with and without prepasteurization. None of the processes inactivated bovine Parvovirus (strain Haden) completely. This virus could not be inactivated in all cases even by pasteurization of the digested sludge. (Author's abstract)
W87-02661

ELECTROFOCUSING OF VIRUSES AND SENSITIVITY TO DISINFECTION,

Surrey Univ., Guildford (England). Dept. of Microbiology.
M. Butler, A. R. Medlen, and G. R. Taylor.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 201-210, October 1985. 10 fig, 18 ref.

Descriptors: *Viruses, *Wastewater treatment, *Disinfection, *Water treatment, *Electrofocusing, *Chlorination, Electrical properties, Chlorine, Bacteriophage, Iodine, Enteroviruses.

Viruses have individual and characteristic isoelectric points and, for poliovirus, there was good evidence for a correlation between one of these and sensitivity to chlorine. However, in the presence of chlorine dioxide, bromine chloride, and iodine, the behavior of poliovirus and f2 coliphage was found to be similar and not apparently influenced by the isoelectric point. (Author's abstract)
W87-02664

BEHAVIOUR OF COLIPHAGES IN OXIDATION PONDS,

Iwate Univ., Morioka (Japan). Dept. of Civil Engineering.
T. Omura, H. K. Shin, and A. Ketratanakul.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 219-227, October 1985. 8 fig, 4 tab, 4 ref.

Descriptors: *Bacteriophage, *Viral inactivation, *Oxidation ponds, *Indicators, *Wastewater treatment, Public health, Viruses, Ponds, Water quality management, Temperature effects, Coliforms, Bacteria, Acidity.

Coliphages are promising indicators of viral inactivation efficiency in wastewater treatment. Coliphage numbers were measured in oxidation ponds

consisting of a series of facultative and maturation ponds, while the effects of temperature and pH on the behavior of coliphages were examined in the laboratory, employing three species of coliform bacteria as host cells. The field investigation demonstrated a positive correlation between counts of coliphages and those of coliform bacteria, and that more than 99% of coliphages were inactivated. The inactivation efficiency of coliphages in the facultative pond was much higher than in the maturation pond. The laboratory experiments indicated that, at 30 C, more than 99% of the coliform group were destroyed in seven days of incubation, and that coliphage counts increased from 100,000/100 ml to 10 to the 7th power/100 ml with a lag time of three days. Greater reduction of the coliform count was obtained at higher incubation temperatures. It was observed that the coliphages possessed greater ability to attack coliform bacteria at acidic rather than alkaline pH. (Author's abstract)
W87-02666

ESTIMATION OF WASTEWATER TREATMENT COSTS: EVALUATION OF THE CAPDET MODEL FOR CANADIAN CONDITIONS,
M. Pineau, P. C. Cote, and J. P. Villeneuve.
Canadian Journal of Civil Engineering CJCEB, Vol. 12, No. 3, p 483-493, September 1985. 6 fig, 6 tab, 9 ref.

Descriptors: *Wastewater treatment, *Cost analysis, *Computer models, *Canada, *Wastewater facilities, *Management planning, CAPDET models, Computer programs, Operating costs, Maintenance costs.

A validation study was carried out to assess the applicability of the CAPDET (computer assisted procedure for the design and evaluation of wastewater treatment systems) model in a Canadian context. On the basis of this study, CAPDET was shown to be an adaptable tool to use in preliminary process design and the prediction of planning-level costs of wastewater treatment plants with acceptable accuracy. For the existing facilities assessed in this study, the total construction cost was predicted within + or - 20% of the actual cost while operation and maintenance costs were estimated with + or - 30% of the observed values. The range of applicability of CAPDET is broad. Case studies with design flow rates ranging from 0.19 to 36.0 MGD (7,200 to 140,000 cu m/day) were checked. Based on the results of this study, the following recommendations are proposed for dealing with the problems identified in applying CAPDET in a Canadian context. (1) Default values for the design parameters should be replaced by the user with appropriate values used in Canada; (2) Default values of the general unit costs must be replaced by the user with local values; (3) In order to account for differences in engineering construction practices, it is suggested to artificially increase the unit costs for excavation, wall concrete, and slab concrete by 25%, 15% and 50%, respectively; (4) Default values for optional unit costs should be used instead of providing the model with values obtained from local suppliers; and (5) For the purpose of estimating operation and maintenance costs, two options can be suggested to the user regarding the labor rate input for manpower. First is the option to input a suggested value of $11.50/h (1980 basis), which using the CAPDET estimates of manpower requirements (person-hour/yr) directly and applying local labor rates to these outputs. (Lantz-PTT)
W87-02670

DESIGN FACTORS FOR THE SCOURING OF DEPOSITED MATERIALS IN WATER AND WASTEWATER TREATMENT SYSTEMS,
Windsor Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 5F.
W87-02674

MICROBIAL POLYMERS IN THE AQUATIC ENVIRONMENT-I: PRODUCTION BY ACTIVATED SLUDGE MICROORGANISMS UNDER DIFFERENT CONDITIONS,
Vysoka Skola Chemicko-Technologicka, Prague (Czechoslovakia). Inst. of Water Technology and Environmental Protection.
J. Hejzlar, and J. Chudoba.
Water Research WATRAG, Vol. 20, No. 10, p 1209-1216, October 1986. 6 fig, 6 tab, 56 ref.

Descriptors: *Aquatic environment, *Activated sludge, *Cultivation conditions, *Polymers, *Wastewater treatment, *Microorganisms, Waste products, Biomass, Aerobic stabilization, Hydrolysis, Sugars, Analytical methods, Chemical oxygen demand, Biological oxygen demand, Chromatography, Bacteria, Biodegradation.

Soluble waste products of activated sludge microorganisms were separated by cultivating mixed cultures under the following conditions: (1) continuous cultivation, (2) aerobic stabilization of biomass under semicontinuous conditions, and (3) batch cultivation with intensive growth. Liquid samples containing the waste products were membrane filtered, concentrated by vacuum distillation and the concentrates were dialysed. The retentate containing polymers with molecular weight (MW) above 10000 were lyophilized and the lyophilisates were hydrolyzed. Chemical oxygen demand (COD) of the isolated polymers with MW above 10000 varied from 32 to 62% of the total COD in the original liquid samples. All isolated polymers containe sugars, amino sugars, uronic acids and amino acids. The sum of these components amounted to 58 to 83% of the volatile fraction of the polymers. The polymers are a mixture of heteropolysaccharides from the outer layers of microbial cells. They are formed during growth and during starvation and decomposition of activated sludge microorganisms. They are very refractory to biodegradation having a biological oxygen demand rate constant of 0.03 - 0.04/day. (See also W87-02695 - W87-02696) (Alexander-PTT)
W87-02694

MICROBIAL POLYMERS IN THE AQUATIC ENVIRONMENT-II: ISOLATION FROM BIOLOGICALLY NON-PURIFIED AND PURIFIED MUNICIPAL WASTE WATER AND ANALYSIS,
Vysoka Skola Chemicko-Technologicka, Prague (Czechoslovakia). Inst. of Water Technology and Environmental Protection.
J. Hejzlar, and J. Chudoba.
Water Research WATRAG, Vol. 20, No. 10, p 1217-1221, October 1986. 3 fig, 4 tab, 11 ref.

Descriptors: *Aquatic environment, *Wastewater treatment, *Secondary wastewater, *Municipal wastewater, *Polymers, *Microorganisms, *Water analysis, Effluents, Ion-exchange capacity, Biodegradability, Biological oxygen command, Sugars, Chemical oxygen demand.

Primary and secondary effluents from the Prague Central Sewage Treatment Plant were filtered through membrane and paper filters, concentrated by vacuum distillation and the concentrates dialysed. The retentates with molecular weight (MW) >10000 were lyophilized and the lyophilizates were hydrolyzed. Part of the concentrated retentate of the secondary effluent was treated by ion-exchange and adsorption chromatography to fractionate the polymers into four groups: basic (7.6%), neutral (28.5%), light yellow acid (46.4%) and dark brown acid (14.2%). The chemical oxygen demand (COD) of the isolated polymers with MW >10000 amounted to 11& and 21.4% of the total COD in the primary and secondary effluent, respectively. All the isolated polymers contained sugars, amino sugars, uronic acids and amino acids. The sum of these compounds amounted to 32.8 - 77.3% of the volatile fraction of the polymers. Both primary and secondary effluents contain microbial polymers originating in the sewer and in the aeration tank during waste water treatment. The polymers are refractory to biodegradation having a biological oxygen demand rate constant of 0.03/day. (See also W87-02694 - W87-02696) (Alexander-PTT)
W87-02695

MEMBRANE FILTRATION ENUMERATION OF FAECAL CLOSTRIDIA AND CLOSTRIDIUM PERFRINGENS IN WATER,
Hydrological Research Inst., Pretoria (South Africa).
For primary bibliographic entry see Field 5A.
W87-02701

RADIATION INDUCED DECOMPOSITION OF SOME CHLORINATED METHANES IN WATER,
Vienna Univ. (Austria). Dept. of Theoretical Chemistry and Radiochemistry.
N. Getoff.
Water Research WATRAG, Vol. 20, No. 10, p 1261-1264, October 1986. 6 fig, 21 ref.

Descriptors: *Radiation, *Chloromethanes, Wastewater treatment, *Water treatment, Biological degradation, Adsorption, Decomposition, Pollutants.

Experimental results on the oxidative radiation induced decomposition of dicloromethane, cloroform and carbon tetrachloride in neutral, aerated aqueous solutions as a function of the absorbed dose were reported. The radiolysis of chloroform was also studied in acid and alkaline media. The formation of Cl(-) ions was taken as an indicator for the decomposition process. Their yield as well as that of the total aldehydes is expressed in initial G-values. In the presence of air, OH, HO2, and/or O2(-) and to some extent H2O2 are the active rediolytic species of water which can attack the pollutant present and initiate its oxidative decomposition. In the case of chlorinated methanes, several chlorine acids can be formed which are strong oxidizing agents and can initiate further pollutant decomposition. (Author's abstract)
W87-02702

SEAWATER INDUCED ALGAL FLOCCULATION,
American Univ., Beirut (Lebanon). Faculty of Engineering and Architecture.
G. M. Ayoub, S.-I. Lee, and B. Koopman.
Water Research WATRAG, Vol. 20, No. 10, p 1265-1271, October 1986. 6 fig, 17 ref.

Descriptors: *Seawater, *Algal control, *Algae, *Flocculation, *Oxidation ponds, *Wastewater treatment, Coagulation, Upgrading, Hydrogen ion concentration, Ions, Photosynthesis, Effluents.

Addition of seawater in concentrations of 5 to 10% by volume to oxidation pond effluents having high pH causes extensive algal flocculation, allowing efficient removal of algae by sedimentation. Two major reactions, CaCO3 and Mg(OH)2 precipitation, are effective in the flocculation of algae in oxidation pond effluent by seawater addition. In the absence of seawater, these reactions are initiated at pH 9.5 and 11.0, respectively. With seawater addition the reactions are initiated at lower pH values. Efficiency of algal removal was dependent on initial pH and seawater concentration, but independent of initial algal concentration. Effluent algal concentration was a function of all three variables. Alkalinity was substantially reduced with the depletion of OH(-) ions as a result of the formation and settling of Mg(OH)2. Reductions were more pronounced at high pH and seawater concentrations. While the studied process is a technically viable one, its applicability must be established by further studies to resolve the following practical aspects: (a) Trapping oxidation pond effluents at periods of high algal activity (high pH); (b) Introducing a reasonably inexpensive system for seawater feed, mixing, flocculation, and settling; (c) Establishment of the quality of the treated effluent to effect proper disposal; (d) Quality of sludge produced and methods of disposal. (Alexander-PTT)
W87-02703

EFFECTS OF CHLOROFORM TOXICITY ON METHANE FERMENTATION,
Drexel Univ., Philadelphia, PA. Environmental Studies Inst.
J. Yang, and R. E. Speece.
Water Research WATRAG, Vol. 20, No. 10, p 1273-1279, October 1986. 12 fig, 11 ref, append.

Descriptors: *Toxicity, *Wastewater treatment, *Chloroform, *Anerobic digestion, *Fermentation, *Methane, Methanogenesis, Biomass, Acclimation, Inhibition, Radiotracers, Microbial degradation, Retention time, Temperature effects.

An acetate enriched, methanogenic culture was able to acclimate to the presence of various concentrations of chloroform while fermenting acetate to methane. The severity and duration of the inhibition of methane fermentation by a slug dose of chloroform was proportional to the toxicant concentration. The system with the longest solids retention time (SRT) could recover from the highest dose of chloroform. Recovery from inhibition was directly related to biomass concentration. Methane fermentation inhibition was directly related to the exposure period of biomass to chloroform and toxicity reversal was demonstrated when the biomass was separated from the supernatant fluid containing chloroform. Previous exposure to chloroform reduced inhibition due to subsequent reinjection of chloroform. At equal biomass concentrations, younger cultures proved more robust and resistant to chloroform than older cultures. Reduced temperature (25 C) significantly delayed recovery of gas production from slug doses of chloroform when compared to normal incubation temperature (35 C). (Alexander-PTT)
W87-02704

STARCH WASTE TREATMENT BY THE ACTIVATED SLUDGE SYSTEM,
National Cheng Kung Univ., Tainan (Taiwan). Dept. of Environmental Engineering.
C. T. Li, O. J. Hao, and K. P. Hsueh.
Water Research WATRAG, Vol. 20, No. 10, p 1281-1289, October 1986. 10 fig, 3 tab, 39 ref.

Descriptors: *Activated sludge process, *Wastewater treatment, *Starch, Degradation, Effluents, Chemical oxygen demand, Cost analysis, Taiwan, Food-processing wastes, Retention time, Dissolved oxygen, Tapioca, Biological oxygen demand, Model studies.

Diluted starch waste (630 - 2200 mg COD/l) was easily degraded by a completely mixed activated sludge treatment system. At least 90% of the influent chemical oxygen demand (COD) and biological oxygen demand can be removed at a hydraulic detention time of 10 h and solids retention time of 4 - 15 days. The effluent COD concentration, specific maximum growth rate, and half-saturation coefficient are all dependent on the influent substrate concentrations. First order approximation, the Monod and multiple-substrate activated sludge models can be used to predict effluent COD concentrations. Only the multi-substrate model is applicable under variable influent substrate concentrations. Contrary to previous studies, no sludge settling problems were observed. However, the dissolved oxygen (DO) concentration in the aeration tank must be maintained above a critical DO level to prevent sludge bulking. The critical DO concentration increases as the food to microorganism ratio increases. Under prolonged mean solids retention time, oxygen transfer may be limited due to higher solids concentration and endogenous oxygen demand. The cost for a hypothetical activated sludge wastewater plant for treating corn starch waste with a flow rate of 300 cu m/day is approx. $240000 which is too expensive for starch producers in Taiwan. (Alexander-PTT)
W87-02705

ENTEROVIRUS REMOVAL FROM SEWAGE: THE EFFECTIVENESS OF FOUR DIFFERENT TREATMENT PLANTS,
Otago Univ., Dunedin (New Zealand). Dept. of Microbiology.
G. D. Lewis, F. J. Austin, M. W. Loutit, and K. Sharples.
Water Research WATRAG, Vol. 20, No. 10, p 1291-1297, October 1986. 3 fig, 4 tab, 22 ref.

Descriptors: *Enteroviruses, *Virus removal, *Wastewater treatment, Effluents, Trickling filtration, Chlorination, Oxidation ponds, Hydrogen ion concentration, Conductivity, Suspended solids, Seasonal variation, Filtration, Pollutants, Water quality standards, Coliforms, Bacteria, Regression analysis.

Human enterovirus removal from effluents at four different sewage treatment plants was tested: an oxidation pond system, two utilizing trickling filtration, and the fourth incorporating sedimentation and chlorination. Virus numbers were not significantly reduced by any of the treatment plants. No correlation was found between virus number and fecal coliforms, suspended solids, pH or conductivity. Seasonal fluctuations in virus numbers indicated that more enteroviruses were present in the summer months than in the winter. (Author's abstract)
W87-02706

EFFECTS OF CYANIDE ON THE METHANOGENIC DEGRADATION OF PHENOLIC COMPOUNDS,
Alberta Univ., Edmonton. Dept. of Microbiology.
P. M. Fedorak, D. J. Roberts, and S. E. Hrudey.
Water Research WATRAG, Vol. 20, No. 10, p 1315-1320, October 1986. 7 fig, 1 tab, 21 ref.

Descriptors: *Cyanide, *Methanogenesis, *Wastewater treatment, *Biodegredation, *Phenols, *Industrial wastewater, *Anerobic digestion, Batch cultures, Bacteria, Toxicity, Inhibition, Hydrocarbons, Effluents, Organic carbon, Fermentation.

The effects of cyanide on the degradation of phenol, m-phenol, p-phenol, catechol and hydroquinone in acclimated methanogenic consortia were studied. Batch cultures with cyanide concentration up to 10 mg/l were monitored for phenolic removal and methane production. Results showed that the methanogenesis was more sensitive to cyanide inhibtion than the phenolic-degrading bacteria. The former group was inhibited by lower cyanide concentrations and took longer to adapt to the toxicant. Phenolic degradation was slowed to varying degrees depending on the phenolic substrate. The additon of 400 mg/l acetate or 0.01 M bromoethane sulfonic acid, a specific inhibitor of methanogenesis, also slowed the rates of phenolic degradation. Thus cyanide can effect a phenolic-degrading consortium by causing an accumulation of end products of the non-methanogenic fermentation (e.g. acetate) because of the inability of the methanogens to consume them. A draw and feed culture adapted to phenol degradation in the presence of 5 mg/l cyanide was able to reduce methane from feed solutions containing 5 mg/l cyanide and 250 mg/l phenol at the same rate as a control culture receiving 250 mg/l phenol but no cyanide. (Author's abstract)
W87-02709

IMPROVED METHOD FOR RECOVERY OF ENTERIC VIRUSES FROM WASTEWATER SLUDGES,
Health Effects Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5A.
W87-02710

PROBLEM OF PHOSPHORUS IN FRANCE - ITS PRESENCE IN NATURAL WATERS AND BIOLOGICAL PHOSPHORUS REMOVAL,
Agence de Bassin Loire-Bretagne, Orleans (France).
For primary bibliographic entry see Field 5G.
W87-02734

BEHAVIOUR OF INTRACELLULAR POLYPHOSPHATE IN THE BIOLOGICAL PHOSPHATE REMOVAL PROCESS,
Tokyo Univ. (Japan). Dept. of Urban and Sanitary Engineering.
T. Mino, T. Kawakami, and T. Matsuo.
Water Science and Technology WSTED4, Vol. 17, No. 11/12, p 11-21, 1985. 7 fig, 2 tab, 11 ref.

Descriptors: *Phosphorus removal, *Phosphates, *Biological wastewater treatment, *Wastewater treatment, *Nutrient removal, *Model studies, Activated sludge, Phosphorus, Phosphorus compounds, Phosphorus radioisotopes, Radioactive tracers, Tracers, Biological treatment, Sludge.

The functions of intracellular polyphosphate in the biological phosphorus removal process were investigated The STS method (a method for the fractionation of phosphorus in biological cells) was used for the determination of polyphosphate and the fractionation of the intracellular phosphorus compounds. The low molecular weight (LMW) polyphosphate and the high molecular weight (HMW) polyphosphate can be determined separately by this method. Radiotracer experiments were performed using 32P-labeled orthophosphate. Chemical analyses of phosphorus and the radioactivity measurement were made simultaneously in the course of the anaerobic oxic process. The mass transfer of phosphorus among the phosphorus compounds was calculated from the results of the radiotracer experiment. It was suggested that the LMW polyphosphate served as the energy source under the anaerobic conditions and that the HMW polyphosphate served as the phosphorus source for the growth reactions. Some models for phosphorus transfer in high phosphorus-accumulating microorganisms were proposed. (Author's abstract)
W87-02735

POLYPHOSPHATE KINASE ACTIVITY DURING PHOSPHATE UPTAKE BY BACTERIA,
Centre des Sciences de l'Environment, Metz (France).
J. T'Seyen, D. Malnou, J. C. Block, and G. Faup.
Water Science and Technology WSTED4, Vol. 17, No. 11/12, p 43-56, 1985. 7 fig, 4 tab, 22 ref.

Descriptors: *Polyphosphate kinase, *Phosphorus removal, *Bacteria, *Phosphates, *Wastewater treatment, *Enzymes, Biological wastewater treatment, Activated sludge, Sludge, Sewage bacteria, Anaerobic conditions, Bacterial physiology, Nutrient removal, Phosphorus.

Polyphosphate kinase, one of the key enzymes for polyphosphate accumulation in bacteria, has been investigated in pure culture and activated sludge samples. Acinetobacter lwoffi, A. phosphadevorus, and Pseudomonas fluorescens appeared to have a polyphosphate kinase activity, while Aeromonas hydrophila, Bacillus subtilis, E. coli, and Serratia sp. showed no measurable activity. Enzyme activity in bacteria depends on environmental conditions and can be induced by anaerobic stress without modification of extracellular phosphate concentrations. Most of the activated sludge samples taken from laboratory pilot plants achieving good phosphorus removal did not present any measurable polyphosphate kinase activity. Such poor results can be related to low numbers of phosphorus removing bacteria and inhibitory molecules in sludge extracts. The only observed activity was in pretreated sludges and in sludges submitted in a batch reactor to phosphate starvation. However, in these, enzyme activity was at least 20 times lower than those measured in pure culture of A. lwoffi. Results show that sludge phosphate uptake potential cannot be predicted by the measure of induction of polyphosphate kinase activity. (Doria-PTT)
W87-02736

KINETICS OF BIOLOGICAL PHOSPHORUS RELEASE,
Cape Town Univ. (South Africa). Dept. of Civil Engineering.
M. C. Wentzel, P. L. Dold, G. A. Ekama, and G. v. R. Marais.
Water Science and Technology WSTED4, Vol. 17, No. 11/12, p 57-71, 1985. 14 fig, 4 ref.

Descriptors: *Phosphorus removal, *Kinetics, *Model studies, *Anaerobic digestion, *Wastewater treatment, Biological treatment, Biological wastewater treatment, Biodegradation, Digestion, Activated sludge, Activated sludge process, Sludge, Nutrient removal, Bacterial physiology, Biochemistry, Metabolism, Bacteria, Phosphorus.

Experimental observations indicate that the magnitude of biological excess phosphorus uptake is linked strongly to the magnitude of P release in the anaerobic reactor. A theory describing the kinetics

of P release is presented. Readily biodegradable COD from the influent is converted via the glycolitic pathway into lower fatty acids by the non-polyP heterotrophs. The rate of conversion appears to be first order with respect to the active non-polyP organism concentration and the readily biodegradable COD concentration. The lower fatty acids are sequestered by the polyP organisms, using energy obtained from hydrolysis of accumulated polyP chains. The rate of sequestration appears to be faster than the rate of conversion, so that the conversion step is rate-limiting for sequestration and hence P release. An important parameter for assessing P release behavior is the fraction of the total sludge in the reactor; because the reaction is first-order, series subdivision of an anaerobic reactor increases P release. A linear relationship was observed between the mass of P release in the anaerobic reactor and the mass of P uptake in the anoxic/aerobic part of the process. Observed P release conforms well to that predicted over a wide range of wastewater characteristics and process conditions. (Doria-PTT)
W87-02737

READILY BIODEGRADABLE FRACTION OF SEWAGE: ITS INFLUENCE ON PHOSPHORUS REMOVAL AND MEASUREMENT,
Johannesburg City Health Dept. Labs. (South Africa).
H. A. Nicholls, A. R. Pitman, and D. W. Osborn.
Water Science and Technology WSTED4, Vol. 17, No. 11/12, p 73-87, 1985. 4 fig, 6 tab, 16 ref.

Descriptors: *Biodegradation, *Wastewater treatment, *Wastewater, *Phosphorus removal, *Monitoring, Phosphorus, Degradation, Nutrient removal, Chemical analysis, Water analysis, Biological wastewater treatment, Biological treatment, Denitrification, Fermentation, Activated sludge, Sludge, Bacteria.

Various full-scale studies on the 5-stage Bardenpho process for biological phosphorus removal are reported with special reference to the role of readily biodegradable substrate in phosphorus removal. Results indicated that efficient denitrification was always a prerequisite for good phosphorus removal. The availability of fermentation products could greatly assist both nitrogen and phosphorus removal. Various options for the generation of these products are presented, and methods for the estimation of readily biodegradable substrates, of which fermentation products can be a component, are evaluated. (Author's abstract)
W87-02738

INTERACTION OF DIFFERENT GROUPS OF MICRO-ORGANISMS IN BIOLOGICAL PHOSPHATE REMOVAL,
National Inst. for Water Research, Pretoria (South Africa).
K. E. U. Brodisch.
Water Science and Technology WSTED4, Vol. 17, No. 11/12, p 89-97, 1985. 3 fig, 4 tab, 12 ref.

Descriptors: *Bacteria, *Phosphorus removal, *Phosphates, *Wastewater treatment, *Biological treatment, Activated sludge, Sludge, Biological wastewater treatment, Nutrient removal, Phosphorus, Acinetobacter, Aeromonas, Bacterial analysis, Water analysis, Anaerobic conditions, Fermentation, Bacterial physiology, Fatty acids.

Observations under continuous flow conditions in a bench-scale activated sludge unit and in full-scale nutrient removal activated sludge plants indicated that no enhanced biological phosphate removal was achieved despite relatively high numbers of Acinetobacter calcoaceticus. Total bacteriological analyses of the mixed liquor of these plants indicated that, in all cases, Aeromonas spp. were present in low numbers, particularly Aeromonas punctata. This bacterium is described as being able to produce acetate as one of its major fermentation end products. Phosphate uptake batch experiments using pure cultures showed that Aeromonas punctata enhances the phosphate uptake capability of Acinetobacter calcoaceticus by converting carbohydrates present in the sewage to a substrate required for phosphate removal. It was shown that the anaerobic zone in a phosphate-removing activated sludge plant is a fermentation reactor, generating suitable substrates rather than imposing stress conditions on the bacteria, a condition which was previously believed to be essential for enhanced phosphate uptake. (Author's abstract)
W87-02739

NEW STRATEGIES FOR THE ISOLATION OF MICROORGANISMS RESPONSIBLE FOR PHOSPHATE ACCUMULATION,
Brandeis Univ., Waltham, MA. Rosenstiel Basic Medical Sciences Research Center.
N. Suresh, R. Warburg, M. Timmerman, J. Wells, and M. Coccia.
Water Science and Technology WSTED4, Vol. 17, No. 11/12, p 99-111, 1985. 7 fig, 3 tab, 31 ref.

Descriptors: *Bacteria, *Phosphates, *Microorganisms, *Wastewater treatment, *Phosphorus removal, *Wastewater, *Sludge, Bioaccumulation, Phosphorus, Acinetobacter, Pseudomonas, Enzymes, Isolation, Bacterial physiology, Accumulation.

Several strategies were used to isolate organisms involved in the uptake and subsequent release of inorganic phosphate from wastewater sludge. These included direct staining for polyphosphates (polyP), growing in 32P-inorganic phosphate followed by autoradiography, resistance to dicyclohexyl carbodiimide (DCCD), an ATPase inhibitor, and isolation on the basis of the buoyant density of the cell. Among those microorganisms isolated were Acinetobacter lwoffi, A. calcoaceticus, and Pseudomonas vesicularis. The Ps. vesicularis culture had 31% of phosphate as polyP. Analysis of the whole cells revealed the presence of polyP when the cultures were grown aerobically to the late stationary phase, and its subsequent loss during anaerobic incubation. Loss of polyP was also associated with a decrease in buoyant density of the cell. In the presence of DCCD, there was a decrease in the polyP peak, but a substantial increase in the sugar phosphates, consistent with the hypothesis that polyP is used as a reserve energy source. Ps. vesicularis cells showed a two-fold increase in the level of polyphosphatase during early stationary phase, but a 30-fold increase in polyphosphate kinase activity during late stationary phase. This increased enzyme activity is consistent with the increased polyP synthesis during late stationary phase. (Author's abstract)
W87-02740

PHOSPHORUS UPTAKE BY KLEBSIELLA PNEUMONIAE AND ACINETOBACTER CALCOACETICUS,
Aquagene Tech Corp., San Diego, CA.
R. M. Gersberg, and D. W. Allen.
Water Science and Technology WSTED4, Vol. 17, No. 11/12, p 113-118, 1985. 2 fig, 1 tab, 8 ref.

Descriptors: *Phosphorus removal, *Klebsiella, *Acinetobacter, *Accumulation, *Wastewater treatment, Nutrient removal, Biological wastewater treatment, Bacteria, Phosphorus, Municipal wastewater, Wastewater, Phosphates.

Pure cultures of Klebsiella pneumoniae and Acinetobacter calcoaceticus can be induced to accumulate large amounts of phosphorus (P) when P-starved cultures are enriched with phosphorus either in suspended growth or immobilized cell reactors. Suspended growth cultures of K. pneumoniae were found to be more efficient than those of A. calcoaceticus. The absolute rate of P accumulation measured for a K. pneumoniae culture was among the highest ever reported in the literature. In an immobilized cell system, which facilitates the separation of the cells (for recycling) from the liquid phase, K. pneumoniae cells entrapped in agar gel beads remained viable and continued to accumulate P. K. pneumoniae cultures also showed a high capacity for removing dissolved phosphate from municipal wastewater, with greater than 95% P removal in two hours. These studies suggest the important role such high-phosphate accumulating bacteria may play in wastewater treatment systems designed for enhanced biological phosphorus removal. (Author's abstract)
W87-02741

SOME PHYSIOLOGICAL CHARACTERISTICS OF ACINETOBACTER SPP. ACCUMULATING LARGE AMOUNTS OF PHOSPHATE,
Agricultural Univ., Wageningen (Netherlands). Dept. of Microbiology.
M. H. Deinema, M. van Loosdrecht, and A. Scholten.
Water Science and Technology WSTED4, Vol. 17, No. 11/12, p 119-125, 1985. 3 fig, 5 tab, 13 ref.

Descriptors: *Phosphorus removal, *Phosphates, *Acinetobacter, *Accumulation, *Wastewater treatment, *Bacterial physiology, Culturing techniques, Metabolism, Bioaccumulation, Ethanol, Organic carbon, Carbon, Activated sludge, Sludge, Nutrient removal.

A specialized group of bacteria belonging to the genus Acinetobacter have a unique phosphate metabolism. Acinetobacter strain 210A was grown in batch and continuous cultures in an acetate medium. During aerobic growth, the cells accumulated phosphate and, under anaerobic conditions, the greater part of this phosphate was released. This phosphate release requires actively metabolizing cells, and cannot be obtained with cells from the stationary growth phase. The P content of the cells varied from 6% to 10% of the dry matter, and phosphate uptake continued for months as long as carbon and nitrogen sources, inorganic salts, and oxygen were present. The rate of phosphate release increases considerably upon addition of acetate and another reduced C source, although, after 24 hours of anaerobiosis, results obtained with or without additions were similar. The obtained phosphate release of pure cultures of Acinetobacter was lower than that of activated sludge containing 25-50% acinetobacters. However, the sludge liquid might have contained very low amounts of appropriate carbon compounds for the metabolism of this Acinetobacter species. (Doria-PTT)
W87-02742

ROLE OF BACTERIAL PHOSPHATE METABOLISM IN ENHANCED PHOSPHORUS REMOVAL FROM THE ACTIVATED SLUDGE PROCESS,
Johannesburg City Health Dept. Labs. (South Africa).
L. H. Lotter.
Water Science and Technology WSTED4, Vol. 17, No. 11/12, p 127-138, 1985. 8 fig, 2 tab, 41 ref.

Descriptors: *Bacterial physiology, *Metabolism, *Phosphates, *Phosphorus removal, *Activated sludge process, *Wastewater treatment, Phosphorus, Nutrient removal, Activated sludge, Sludge, Biological wastewater treatment, Biological treatment, Anaerobic conditions, Enzymes, Acinetobacter, Organic carbon, Carbon, Fermentation, Microbiological studies, Bacteria.

Phosphate metabolism was investigated in relation to biological phosphorus removal. Bacterial population studies of activated sludge plants revealed the predominance of Acinetobacter spp.; studies of these isolates showed a number of strains capable of reducing nitrate to nitrogen. Growth of Acinetobacter isolates on a variety of carbon sources showed that not only growth, but also polyphosphate accumulation is stimulated by short-chain carbon compounds, such as acetate and butyrate, which are products of bacterial fermentation. Assays of anaerobic zone mixed liquor samples indicated high activity of key enzymes in the formation of these compounds. Phosphate uptake under various conditions underlined the sensitivity of bacterial phosphorus metabolism to external factors. The origin of the orthophosphate released in the anaerobic zone points strongly to hydrolysis of polyphosphate to orthophosphate rather than the formation of adenosine triphosphate (ATP). The anaerobic zone is seen as a qualifying zone where cells are preconditioned for optimum phosphorus removal in subsequent zones. (Doria-PTT)
W87-02743

AUT-ECOLOGICAL STUDY OF ACINETOBACTER IN ACTIVATED SLUDGE,
Pretoria Univ. (South Africa). Dept. of Microbiology and Plant Pathology.
T. E. Cloete, P. L. Steyn, and L. Buchan.
Water Science and Technology WSTED4, Vol. 17, No. 11/12, p 139-146, 1985. 5 tab, 8 ref.

Descriptors: *Acinetobacter, *Wastewater treatment, *Activated sludge, *Phosphorus removal, *Bacterial physiology, Activated sludge process, Sludge, Phosphorus, Phosphates, Ecology, Microbiological studies, Bacteria, Population density, Density, Accumulation, Biological treatment.

Data are reported on the role of Acinetobacter in phosphate removal in activated sludge. The fluorescent antibody (FA) technique indicated that Acinetobacter was present in numbers exceeding one million organisms per cu cm throughout all zones of the activated sludge process, with higher numbers occurring in the aeration zone. Acinetobacter numbers remained constant whether phosphate was removed or not. Combined electron microscopy and electron dispersive micro-analysis of X-rays (EDAX) furthermore indicated that bacteria from phosphate-removing activated sludge plants contained phosphate granules, whereas those from non-removing plants or from plants where removal had stopped did not contain phosphate granules at all. It was concluded that no major population shifts of Acinetobacter occurred in activated sludge, and that the process of phosphate accumulation is induced in Acinetobacter. However, Acinetobacter never occurred in numbers large enough to account for phosphate removal to the extent sometimes observed in activated sludge. (Author's abstract)
W87-02744

EXCHANGE OF ORGANICS, PHOSPHATE AND CATIONS BETWEEN SLUDGE AND WATER IN BIOLOGICAL PHOSPHORUS AND NITROGEN REMOVAL PROCESSES,
Technical Univ. of Denmark, Lyngby. Dept. of Sanitary Engineering.
E. Arvin, and G. H. Kristensen.
Water Science and Technology WSTED4, Vol. 17, No. 11/12, p 147-162, 1985. 9 fig, 3 tab, 14 ref.

Descriptors: *Wastewater treatment, *Organic compounds, *Phosphates, *Cations, *Sludge, *Phosphorus removal, *Nitrogen removal, *Biological treatment, Phosphorus, Wastewater, Nitrogen, Nutrient removal, Anaerobic digestion, Digestion, Biodegradation, Potassium, Magnesium, Calcium, Anaerobic conditions.

The stripping of phosphorus, potassium, and magnesium, and uptake of organic substrate and calcium were studied in the anaerobic reactors of two biological phosphorus and nitrogen removal plants. Most of the experiments were performed in batch systems simulating the function of the anaerobic reactor. Acetate, propionate, and lactate addition to the sludge under anaerobic conditions resulted in a significant P release. The P release with glucose was significantly smaller. Approximate values for the Delta-P/Delta-COD ratios were estimated. Average Delta-K/Delta-P and Delta-Mg/Delta-P values were estimated to about 0.29 and 0.25 mg/mg, respectively. Phosphate appears to be precipitated simultaneouly with the biological P-stripping. About 60% of the total phosphate was found to be precipitated, irrespective of the total P content in the sludge. Calcium and magnesium are the dominating counterions, the (Ca+Mg)/P molar ratio being about 1.1. Some iron appears also to be associated with the phosphate, 0.6% of the dry sludge. (Author's abstract)
W87-02745

BIOLOGICAL PHOSPHORUS REMOVAL IN COMBINATION WITH SIMULTANEOUS PRECIPITATION,
G. Spatzierer, C. Ludwig, and N. Matsche.
Water Science and Technology WSTED4, Vol. 17, No. 11/12, p 163-176, 1985. 11 fig, 5 tab, 9 ref.

Descriptors: *Phosphorus removal, *Wastewater treatment, *Biological treatment, *Performance evaluation, *Biological wastewater treatment, Nutrient removal, Phosphorus, Nitrification, Denitrification, Anaerobic conditions, Activated sludge, Bulking sludge, Sludge, Nitrogen removal, Nitrogen.

Two treatment plants with nitrification-denitrification and simultaneous precipitation of P were operated with an anoxic-anaerobic aeration tank to obtain biological P removal. The results indicated that a complete denitrification is essential in the first tank to obtain release and biological uptake of phosphorus. Low loading in one plant resulted in incomplete denitrification and a biological P removal of only 60%. The dosage of a reduced amount of precipitant indicated a combined action of chemical and biological P removal. In another plant with the same mode of operation (two aeration tanks, of which the first was kept anoxic-anaerobic), a biological P-removal of more than 90% was obtained under optimal process conditions. Removal efficiency was reduced by low temperatures: this effect could be counteracted by reduced amount of precipitant. (Doria-PTT)
W87-02746

PHOSPHORUS REMOVAL AT LOW SLUDGE LOADINGS,
Agricultural Univ., Wageningen (Netherlands). Dept. of Water Pollution Control.
J. H. Rensink, H. J. G. W. Donker, and T. S. J. Simons.
Water Science and Technology WSTED4, Vol. 17, No. 11/12, p 177-186, 1985. 9 fig, 5 tab, 9 ref.

Descriptors: *Wastewater treatment, *Domestic wastes, *Phosphorus removal, *Sludge, *Performance evaluation, *Pilot plants, Nutrient removal, Fatty acids, Rainfall, Retention time, Phosphorus, Anaerobic conditions, Plug flow, Flow.

Pilot plant studies for phosphorus removal with settled domestic wastewater at low loadings resulted in 40-50% P-removal. Addition of 100 mg acetic-acid-Chemical oxygen demand (COD) per liter wastewater at low sludge loadings showed a P-removal of more than 97.5%, even at long periods of rainfall. Instead of dosing acetic acid, experiments were carried out by prolongation of the sludge retention time in the anaerobic zone to promote production of low fatty acids. Stirring for half an hour followed by three hours non-stirring of the anaerobic zone improved the P-uptake to 79%. Since the latter method did not lead to P-effluent values of less than 1 mg/l, biological P-removal experiments were carried out supported by partly P-stripping of the sludge. The P-effluent content dropped to a constant value of 0.4 mg P/l, or more than 97.5% P-removal. The P-effluent value remained 0.4 mg P/l during long periods of rainfall. (Doria-PTT)
W87-02747

FACTORS AFFECTING BIOLOGICAL REMOVAL OF PHOSPHORUS,
Kurita Water Industries Ltd., Yokohama (Japan). Kurita Cental Labs.
T. Fukase, M. Shibata, and Y. Miyaji.
Water Science and Technology WSTED4, Vol. 17, No. 11/12, p 187-198, 1985. 10 fig, 5 tab, 3 ref.

Descriptors: *Phosphorus removal, *Wastewater treatment, *Biological treatment, *Pilot plants, *Performance evaluation, *Optimization, *Phosphorus, Nutrient removal, Anaerobic conditions, Aerobic conditions, Municipal wastewater, Retention time, Activated sludge process.

A pilot plant study on biological removal of phosphorus was conducted over 15 months to obtain optimum operational conditions and evaluate process performance. The pilot plant was composed of an anaerobic zone followed by an aerobic zone, and had a capacity of treating 100 cu m municipal wastewater per day. In the anaerobic zone, biological oxygen demand (BOD) loading rates and BOD to MLSS ratios were found to be important factors. In the aerobic zone, on the other hand, the hydraulic retention time had a significant influence on the phosphorus removal efficiency. For successful removal of phosphorus, a shorter hydraulic retention time in the aerobic zone along with appropriate parameters in the anaerobic zone are essential (BOD loading rate less than or equal to 2 kg-BOD/kg-MLSS day, BOD to MLSS ratio less than or equal to 0.1 kg-BOD/kg-MLSS). (Author's abstract)
W87-02748

IMPORTANCE OF THE ACIDOGENIC MICROFLORA IN BIOLOGICAL PHOSPHORUS REMOVAL,
Lyonnaise des Eaux, Le Pecq (France). Lab. Central.
M. Meganck, D. Malnou, P. Le Flohic, G. M. Faup, and J. M. Rovel.
Water Science and Technology WSTED4, Vol. 17, No. 11/12, p 199-212, 1985. 6 fig, 8 tab, 15 ref.

Descriptors: *Wastewater treatment, *Phosphorus removal, *Biological treatment, *Bacteria, *Nitrogen removal, *Microbiological studies, Nutrient removal, Phosphorus, Nitrogen, Nitrification, Sludge, Bacterial physiology, Fatty acids, Eutrophication, Denitrification, Pilot plants, Europe.

Laboratory and semi-industrial scale pilot plant experiments were carried out to study the possibility of simultaneous biological nitrogen and phosphorus removal under European winter temperature conditions. Whereas nitrogen removal requires very long aerated sludge ages, phosphorus removal seems to be somewhat inhibited by the low sludge loadings. Experiments with fatty acid addition to the influent wastewater have shown the acidogenic phase to be the step most sensitive to low load conditions. The phosphorus release and uptake mechanism in itself may be slowed down by lower temperatures, but still has some activity. A microbiological study of the organisms in the sludge undertaken to discover which organisms were responsible for the different steps in the phosphorus removal mechanism, indicated the presence of a considerable number of bacteria belonging to the Pseudomonas genus and to the Aeromonas group. In three of four screenings, bacteria of the Acinetobacter-Moraxella group were also present. (Author's abstract)
W87-02749

BIOLOGICAL PHOSPHORUS AND NITROGEN REMOVAL AT AN EXPERIMENTAL FULL SCALE PLANT IN THE U.K.,
Satec Ltd., Crewe (England).
A. G. Best, C. J. Hatton, A. J. Rachwal, and B. Hurley.
Water Science and Technology WSTED4, Vol. 17, No. 11/12, p 213-232, 1985. 16 fig, 18 ref.

Descriptors: *Wastewater treatment, *Phosphorus removal, *Nitrogen removal, *Nutrient removal, *Activated sludge process, *Wastewater facilities, *Biological treatment, Aeration, Anaerobic conditions, Denitrification, Biological wastewater treatment, Wastewater treatment, Monitoring, Nitrification, Activated sludge, Sludge, Cost analysis, Performance evaluation, Cost-benefit analysis.

A project to improve the performance of a conventional diffused air activated sludge plant was carried out by the Thames Water Authority on a 4,000 cu m/day stream from 1981-1984. The modified plant (ROTANOX) comprised the use of rotary flow through two adjacent aeration lanes with an anoxic section for denitrification. In the last year of the study, an anaerobic zone was created at the front of the plant, and biological phosphorus removal was monitored after establishment of the necessary operating conditions. An effluent with a mean of 4 mg/l BOD, 11 mg/l SS, and 2 mg/l NH3-N was achieved during the first two years of operation; energy consumption was reduced by 15%. In the final year, a mean total P removal of 5.7 mg/l was recorded with the highest monthly average being 10 mg/l removal. This was equivalent to mean percentage removal of 40% and 47%, respectively. (Doria-PTT)
W87-02750

POLYMER FLOTATION AND ACTIVATED CARBON ADSORPTION TREATMENT FOR IN SITU TAR SAND PROCESS WATER,
Oklahoma State Univ., Stillwater. School of Civil Engineering.
W. F. McTernan, W. E. Blanton, G. D. Boardman, B. T. Nolan, and D. J. Kocornik.
Environmental Progress ENVPDI, Vol. 5, No. 3, p 154-158, August 1986. 4 fig, 5 tab, 11 ref.

Descriptors: *Polymers, *Activated carbon, *Adsorption, *Wastewater treatment, *Flotation, *Industrial wastewater, *Process water, *Performance evaluation, Carbon, Wastewater, Chromatography, Organic compounds, Chemical analysis, Water analysis, Effluents, Toxicity.

Process waters collected during a Department of Energy's in situ tar sand extraction experiment near Vernal, Utah were treated by polymer-assisted induced air flotation and activated carbon adsorption. The flotation process removed more than 99% of the organic load as emulsified bitumen, but did little to reduce residual toxicity in the effluents. Activated carbon adsorption was needed to remove the toxic materials from the waste stream. Polymer doses were quite high, indicating that additional testing may be warranted. GC/MS analysis, using a modification of EPA Method 625, yielded an estimated 2,000 compounds in the untreated process water. Internal and recovery standards present at 10 ppm were totally obscured in the chromatogram. Flotation effluents contained 39 identified organic compounds, none of which was listed on EPA's hazardous chemicals list. Internal and recovery standards were immediately visible in the chromatogram. The GC/MS analysis was unable to determine the chemical basis for the toxic properties present. It is concluded that the emerging tar sand production industry may require the development of innovative monitoring protocols to gauge its impacts. (Doria-PTT)
W87-02751

APPLICATION OF ALUMINAS IN WATER TREATMENT,
Aluminum Co. of America, Alcoa Center, PA. Alcoa Labs.
H. L. Fleming.
Environmental Progress ENVPDI, Vol. 5, No. 3, p 159-166, August 1986. 16 fig, 2 tab, 31 ref.

Descriptors: *Alumina, *Process water, *Groundwater, *Water treatment, *Wastewater treatment *Adsorption, *Technology, *Performance evaluation, Wastewater, Selenium, Dissolved solids, Metal-finishing wastes, Heavy metals.

Removal of contaminants from process and waste water by adsorption with transition aluminas is receiving increased attention. As separation requirements become more stringent, the advent of controlled surface chemistry and pore morphology in adsorbent processing has resulted in innovative application of these materials to water treatment. Current technology is reviewed. Emerging processes utilizing these versatile materials are examined. Potential applications include removal of selenium and tribalocarbons from groundwater, removal of dissolved organic compounds (especially carboxylic acids), alcohol/water separation, removal of heavy metals from electroplating wastes, and treatment of amine-containing waters. (Doria-PTT)
W87-02752

DEVELOPMENT OF A COMBINED ULTRAFILTRATION AND CARBON ADSORPTION SYSTEM FOR INDUSTRIAL WASTEWATER REUSE AND PRIORITY POLLUTANT REMOVAL,
ARATEX Services, Inc., Encino, CA.
G. Van Gils, and M. Pirbazari.
Environmental Progress ENVPDI, Vol. 5, No. 3, p 167-170, August 1986. 4 fig, 3 tab, 12 ref.

Descriptors: *Ultrafiltration, *Activated carbon, *Laundry wastewater, *Adsorption, *Industrial wastewater, *Water reuse, *Wastewater treatment, *Performance evaluation, Optimization, Cost analysis, Coagulation, Pilot plants, Flocculation, Sedimentation, Heavy metals, Odors, Organoleptic properties, Water properties, Color removal, Optical properties.

Experiments have been carried out to help develop cost-effective wastewater treatment systems for the industrial laundry industry. Bench-scale investigations were conducted to optimize the coagulation, ultrafiltration, and adsorption processes through the use of jar tests, adsorption equilibrium studies, and other procedures. This was followed by a pilot plant study and a full-scale system designed to handle 180 gallons per minute of wastewater flow. The full-scale system consists of fine screening and equalization, coagulation (using hydrated lime) and flocculation, settling, ultrafiltration with activated carbon, and permeate neutralization (with sulfuric acid). System performance has been satisfactory; the high flux rates attained in the pilot study were achieved in the full-scale system even though the levels of wastewater oils and greases were higher. Removal of conventional pollutants has been similar to pilot-plant results, with reduction in suspended solids and freon-extractable oils and greases always greater than 90%. Heavy metals were removed, mostly to below detection limits. Odors and colors appear to have been removed. Evaluations are continuing to determine the steady-state and long-term impact of product water reuse and to measure the cost-effectiveness of this treatment process. (Doria-PTT)
W87-02753

ORTHANILIC ACID AND ANALOGUES AS CARBON SOURCES FOR BACTERIA: GROWTH PHYSIOLOGY AND ENZYMIC DESULPHONATION,
Eidgenoessische Technische Hochschule, Zurich (Switzerland). Inst. fuer Mikrobiologisches.
T. Thurnheer, T. Kohler, A. M. Cook, and T. Leisinger.
Journal of General Microbiology JGMIAN, Vol. 132, No. 5, p 1215-1220, May 1986. 1 fig, 2 tab, 29 ref.

Descriptors: *Carbon cycle, *Desulfonation, *Bacteria, *Orthanilic acid, *Growth, *Bacterial physiology, *Enzymes, *Sulfur cycle, Carbon, Metabolism, Sulfur, Sulfur compounds, Aerobic conditions, Culture media, Culturing techniques, Microbiological studies, Pseudomonas, Sulfonates, Biodegradation, Degradation, Wastewater treatment.

Carbon-limited aerobic batch enrichment media were used to isolate 17 bacteria able to degrade orthanilic acid (2-aminobenzenesulfonic acid), sulfanilic acid, sulfonamide, 4-sulfobenzoic acid, and benzene-, toluene-, and phenolsulfonic acids. Each organism was capable of utilizing one to three of the substances. Strain O-1, a Pseudomonas sp. utilizing three of these compounds, was studied in detail. A complete mass balance was obtained for the growth of the organism in medium containing, for example, orthanilic acid, and a specific growth rate of 0.1/h was observed. Cell extracts desulfonated six aromatic sulfonates. The enzyme(s) was soluble and was not synthesized in succinate-grown cells. Enzyme activity was dependent on the presence of catalytic amounts of NAD(P)H. (Author's abstract)
W87-02781

ANAEROBIC TREATMENT OF COKE PLANT WASTE WATER,
Centre d'Etude et de Documentation de l'Environnement, Liege (Belgium).
F. Edeline, G. Lambert, and H. Fatticcioni.
Process Biochemistry PRBCAP, Vol. 21, No. 2, p 58-60, April 1986. 5 fig, 2 tab, 4 ref.

Descriptors: *Anaerobic digestion, *Coke wastes, *Wastewater, *Wastewater treatment, *Industrial wastewater, Biodegradation, Biological treatment, Digestion, Activated carbon, Carbon, Fluidized bed process, Phenol.

Coke plant wastewater has been successfully treated by means of a two-stage anaerobic reactor. No prior dilution is required if the total phenol content does not exceed 1,250 mg/l. The reactor consists of an activated carbon fluidized bed followed by a polyurethane foam fixed bed. Effluent phenol is less than 10 mg/l, although sulfocyanide is not removed. (Doria-PTT)
W87-02783

SALMONELLAE AND POLLUTION INDICATOR BACTERIA IN MUNICIPAL AND FOOD PROCESSING EFFLUENTS AND THE CORNWALLIS RIVER,
Environmental Protection Service, Dartmouth (Nova Scotia).
A. S. Menon.
Canadian Journal of Microbiology CJMIAZ, Vol. 31, No. 7, p 598-603, July 1985. 1 fig, 2 tab, 22 ref.

Descriptors: *Salmonella, *Bacteria, *Bioindicators, *Municipal wastewater, *Effluents, *Food-processing wastes, *Water quality, Indicators, Wastewater, Industrial wastes, Coliforms, Streptococcus, Aeromonas, Water quality control, Water quality management, Water quality standards, Bacterial analysis, Water analysis.

A study was conducted to determine the incidence of fecal coliforms, fecal streptococci, Aeromonas hydrophila, and Salmonella spp. in the waste discharges of seven sewage treatment plants and seven food-processing plants located along the Cornwallis River in Nova Scotia, Canada. Surface water samples were also collected from 13 locations in the river to assess the impact of these waste discharges on the receiving water quality. The final effluents from most of the plants were found to be of very poor bacteriological quality, the number of indicator bacteria being comparable with those found in raw sewage. Salmonellae were isolated from the effluents of the meat and poultry plants and five of the seven sewage treatment plants surveyed. No salmonellae were detected in the effluents of the fruit and vegetable canneries. The impact of the discharge of untreated municipal and food-processing wastes on the Cornwallis River water quality was demonstrated by the recovery of five Salmonella serotypes, and by fecal coliform counts exceeding the recommended limit for bathing and shellfish harvesting. (Author's abstract)
W87-02815

BIOLOGICAL PHOSPHORUS REMOVAL: A TECHNOLOGY EVALUATION,
Brown and Caldwell, Pleasant Hill, CA.
M. J. Tetreault, A. H. Benedict, C. Kaempfer, and E. F. Barth.
Water Pollution Control Federation Journal JWPFA, Vol. 58, No. 8, p 823-837, August 1986. 11 fig, 11 tab, 22 ref. EPA Contract 68-03-1818.

Descriptors: *Phosphorus removal, *Wastewater treatment, *Phosphorus, *Biological wastewater treatment, *PhoStrip process, Activated sludge process, Performance evaluation, Biological process, Anaerobic treatment, Sludge blankets.

Phosphorus removal was studied at four full-scale plants. The PhoStrip and operationally modified activated sludge processes achieved effluent total phosphorus concentrations less than 1 mg/liter under nitrifying conditions without tertiary treatment. To achieve this level, both soluable and suspended phosphorus had to be removed. The PhoStrip process is effective at lower ratios of BOD:total P because its sidestream chemical phosphorus removal process is a flexible operation. Good performance in the operationally modified activated sludge processes was attributed to favorable influent wastewater characteristics (BOD:total P ratio $>$ 20 and soluble BOD:soluble P ratio $>$ 12-15). Nitrification and denitrification were compatable with phosphorus removal. Nitrification affected performance only when effluent total P was $<$ 1 mg/liter. Adequate aeration ($>$2 mg/liter of dissolved oxygen) aided phosphorus uptake. To minimize anaerobic conditions the sludge blanket levels were maintained at $<$ 1 ft in the secondary clarifiers. Phosphorus recirculation to the mainstream process was reduced by effective solids processing. (Cassar-PTT)
W87-02820

NUTRIENT TRANSFORMATION IN RETENTION/DETENTION PONDS RECEIVING HIGHWAY RUNOFF,
University of Central Florida, Orlando. Dept. of Civil Engineering and Environmental Sciences.
Y. A. Yousef, T. Hvitved-Jacobsen, M. P. Wanielista, and R. D. Tolbert.
Water Pollution Control Federation Journal JWPFA, Vol. 58, No. 8, p 838-844, August 1986. 9 fig, 4 tab, 20 ref.

Descriptors: *Wastewater treatment, *Detention ponds, *Nitrification, *Denitrification, *Retention ponds, *Ponds, *Highway runoff, *Nutrients, Phosphorus, Nitrogen, Sediments, Sediment-water interfaces.

Two retention ponds in Florida receiving highway runoff were studied. The calculated phosphorus and nitrogen loadings were 5.5 and 34.6 g/sq m/a for the Maitland pond and 1.5 and 6.8 g/sq m/year for the EPCOT pond, respectively. About 99% of the total phosphorus loading had accumulated in the sediments, and 85-90% of the total nitrogen input had been removed, probably by denitrification. It was believed that an anaerobic environment at the water sediment interface enhanced phosphorus removal and facilitated nitrification/denitrification. The older pond (Maitland) showed higher removal efficiency than the newer EPCOT pond. Recommendations derived from this study included (1) A surface area representing 6% of the drainage basin area can have loadings as high as 5 and 30 g/sq m/year for total P and total N, respectively. (2) An aerobic environment at the sediment-water interface is important. To achieve this, ponds should be no greater than 1.5 to 2.0 meters deep. (3) Maintenance procedures should be developed based on older ponds, perhaps 15-20 years old. (Cassar-PTT)
W87-02821

SINGLE-SLUDGE NITROGEN REMOVAL: MODELING AND EXPERIMENTAL RESULTS,
Technion - Israel Inst. of Tech., Haifa. Faculty of Civil Engineering.
Y. Argaman, and A. Brenner.
Water Pollution Control Federation Journal JWPFA, Vol. 58, No. 8, p 853-860, August 1986. 12 fig, 1 tab, 22 ref.

Descriptors: *Wastewater treatment, *Nutrients, *Nitrogen, *Model studies, *Biological wastewater treatment, *Single-sludge system, Activated sludge process, Denitrification, Mathematical models, Alkalinity, Nitrates, Chemical oxygen demand.

Four continuous-flow activated sludge units were operated in the single-sludge mode. The feed was domestic wastewater spiked with carbonaceous organics and ammonium chloride. Kinetic, stoichiometric and materials balance equations were examined and incorporated into a mathematical model for design purposes. The main conclusions of the study were as follows: (1) The aerobic basin of a single-sludge system must provide an aerobic sludge age greater than a critical value (2.5 days at 20 C). (2) The reaction is described as first-order with a nondegradable residual. The rate coefficient was 0.026 liters/mg/d and the nondegradable fraction was 14 mg/liter. (3) Nitrate utilization coefficients were 0.144 g nitrate-N/g COD and 0.007 g nitrate-N/g Volatile suspended solids (VSS)/d. (4) Alkalinity data is useful for monitoring and control of the single-sludge process. (5) The minimum attainable effluent nitrate is inversely proportional to the overall recycle rate. (6) The autotroph fraction increased with increasing ammonia-to-COD removal ratio. The fraction of the heterotrophs that denitrify depends on the actual denitrified nitraate-to removed COD ratio. (Cassar-PTT)
W87-02823

WATERFORD TREATMENT PLANT - A SMALL TOWN LAGOON SYSTEM,
Loudoun County Sanitation Authority, Leesburg, VA.
T. Jackson, and D. C. Hammes.
Operations Forum, Vol. 3, No. 7, p 14-19, July 1986. 3 fig.

Descriptors: *Wastewater treatment, *Lagoons, Chlorination, Aeration, Algal control, *Waterford, Virginia, Flow distribution, Biological wastewater treatment.

The wastewater treatment facility at Waterford, Virginia, preserves the historic and artistic environment of the village while meeting discharge standards. The $750,000 collection system and aerated lagoon facility, designed for an average flow of 58,000 gallons per day, uses the process of extended aeration through aerobic lagoons. Its components are a raw wastewater pumping station, flow distribution boxes, two aerobic lagoons, two biological solids spearation units, and chlorine disinfection unit. Several special techniques and modifications have been implemented at the plant. An inexpensive influent metering system was devised, using two household clocks connected to the pump indicator lights. Algae are controlled with Curtrine or copper sulfate applied to the lagoon surfaces. During periods of excessive algal growth, alum at 400 g per gal of water is used to coagulate the excess suspended material just prior to the final clarifiers. The variable flow entering the chlorine contact chamber is controlled by using baffles with different size holes in Distribution Box D. This allows more stable chlorine residuals. (Cassar-PTT)
W87-02834

MEASURING SLUDGE CONCENTRATION AND QUALITY,
Salina Area Vocational-Technical School, KS.
T. Hobson.
Operations Forum, Vol. 3, No. 7, p 20-25, July 1986.

Descriptors: *Wastewater treatment, *Sludge, *Suspended solids, Activated sludge process, Bacteria, Sewage bacteria, Sedimentation, Sludge solids.

Methods for measuring the concentration of bacteria (solids) throughout an activated sludge plant. These include a (1) settleability test using a jar or graduated cylinder, (2) centrifugation test, (3) measuring total suspended solids by various standard methods, and (4) measuring volatile suspended solids. The data obtained from these tests can be converted into numbers that represent the amount of sludge in the process. (Cassar-PTT)
W87-02835

FUNDAMENTALS OF ANAEROBIC DIGESTION OF WASTEWATER SLUDGES,
Iowa Univ., Iowa City. Dept. of Civil and Environmental Engineering.
G. F. Parkin, and W. F. Owen.
Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 5, 867-920, October 1986. 19 fig, 11 tab, 151 ref.

Descriptors: *Anerobic digestion, *Sludge digestion, *Literature reviews, *Municipal wastes, *Biodegradability, Design, Training, Stabilization, Sedimentation, Trickling filters, Microbial processes, Bacteria, Process kinetics, Methanogenesis, Biological treatment, Retention time, Mixing, Activated sludge.

A literature review of anaerobic digestion of municipal wastewater sludges focuses on the fundamentals of anerobic digestion, setting forth a checklist for review of key process factors including: retention time, mixing, pH, temperature, nutrients, toxic materials, and feed characteristics. Major areas discussed are the microbiology and biochemistry of digestion, kinetics of digestion, environmental factors, process performance indices, product stability, and laboratory and pilot studies on digestion. Although the text is aimed at digestion of municipal sludges, the fundamentals are sufficiently general to permit extrapolation to decomposition of other organics. (Author's abstract)
W87-02884

USE OF GEOSTATISTICS TO PREDICT VIRUS DECAY RATES FOR DETERMINATION OF SEPTIC TANK SETBACK DISTANCES,
Arizona Univ., Tucson. Dept. of Microbiology and Immunology.
For primary bibliographic entry see Field 5B.
W87-02895

METHOD FOR DETERMINING VIRUS INACTIVATION DURING SLUDGE TREATMENT PROCESSES,
Zurich Univ. (Switzerland). Inst. of Virology.
For primary bibliographic entry see Field 5A.
W87-02898

OPERATOR'S GUIDE TO PROTOZOA AND THEIR ROLE IN THE ACTIVATED SLUDGE PROCESS,
M. H. Gerardi.
Public Works PUWOAH, Vol. 117, No. 7, p 44-47,90,92, July 1986. 3 fig, 2 tab, 7 ref.

Descriptors: *Protozoa, *Activated sludge process, *Wastewater treatment, *Operating policies, Wastewater, Activated sludge, Bioindicators, Sludge, Stabilization.

The activated sludge process provides an ideal habitat for many protozoa which exist in large numbers and perform many beneficial roles in wastewater treatment, including: (1) clarification of secondary effluent through the removal of bacteria, (2) degradation of organic waste, (3) flocculation of suspended matter and their use as indicator microorganisms of activated sludge condition and (4) effluent quality. There are many environmental factors such as the bacterial flora, the dissolved oxygen concentration, and sewage strength that affect the population fluctuations of protozoa within the activated sludge process. Protozoa are of importance to the activated sludge process because they improve the quality of the effluent through the enhancement of biological flocculation and predation upon bacteria. They can be used as biological indicators of sludge conditions and effluent quality by providing a quick, reliable and easy examination of operational or loading condition problems, or the progress of operational changes to improve treatment efficiency. Their significance to the optimum operation of an activated sludge plant can only be emphasized by their use as biological indicators by wastewater treatment operators and technicians. (Khumbatta-PTT)
W87-02903

ADAPTING INDUSTRIAL APPROACHES TO MUNICIPAL WASTEWATER TREATMENT PROBLEMS,
Engineering-Science, Inc., Atlanta, GA.
D. Burstein.
Public Works POWOAH, Vol. 117, No. 7, p 68-71, July 1986. 2 fig, 1 tab.

Descriptors: *Wastewater treatment, *Municipal wastewater, Wastewater management, Government finances, Industrial wastewater, Wastewater, Management planning, Sludges.

Most municipal wastewater treatment facilities operating today were built under Public Law 92-500, which provided federal funding for these plants. Recently funds have been cut, and the money coming in has 'strings' attached. Among these are a plethora of EPA regulations dictating how sewage facilities must be planned, built and operated. This article describes some approaches that can be implemented by municipal officers in sewerage programs, and how municipalities can use methods practiced successfully by private industry for many years, to build and operate water pollution control facilities. To do this, it is necessary to compare the two entity organizational structures. In a typical industrial situation, the first attempt to solve problems is through improved operation and maintenance. The next is to implement minor improvements to existing facilities. If this is still insufficient, an analysis is made to determine if the plant's profitability supports a major capitol investment. In many municipalities the decision to take on a major capitol project is often the first choice rather than a last resort. A good O&M consultant can provide the municipality with the benefits of expe-

rience gained while working with similar clients around the country. There are times when capitol projects are unavoidable but in the meantime, privatization is one way municipal officials can take advantage of industrial approaches. (Khumbatta-PTT)
W87-02905

DUAL-USE FILTERS KEEP WET-WEATHER FLOWS UNDER CONTROL,
Wheaton Sanitary District, IL.
R. L. Clavel, and M. A. Scalise.
Water Engineering and Management WENMD2, Vol. 133, No. 6, p 33-35, June 1986. 2 tab.

Descriptors: *Wheaton, *Sand filters, *Storm events, *Storm wastewater, *Effluents, *Dual-use filters, *Precipitation, *Wastewater treatment, Flows, Flood, Activated sludge process, Chlorination, Settling tanks.

Innovative/alternative technology funding helped a Midwest sanitary district undertake and complete a needed expansion. A dual application of rapid sand filters allows the facility to handle wet weather flow excesses and retain control of plant effluent quality. The Wheaton, Illinois Sanitary District has completed a storm water bypass system with other plant improvemnts in 1985. The new process diverts flow above 14.5 mgd to a modified excess-flow treament scheme. Depending on the expected duration and intensity of a storm event, excess flow is either directed to the retention ponds or split between the ponds and the sand filters. The six Hydro-Clear rapid sand filter cells, comprising a total of over 2,200 sq ft of filtering surface, are taken off line as tertiary filters and established as 5.7 mgd primary effluent filters. Trickling filter and activated sludge processes treat up to 13.4 mgd more in a separate, biological stream, and the effluent from all processes is then blended, chlorinated and discharged. Primary effluent can be routed to the filters directly from primary settling tanks or from the retention ponds. More than three-quarters of the plant expansion cost was covered by EPA grants. In addition, the dual use, qualified the project as an innovative technology application. (Khumbatta-PTT)
W87-02926

ASSESSMENT OF ODOROUS EMISSIONS FROM SEWAGE PUMPSTATIONS,
Geological Survey, Arvada, CO. Water Resources Div.
L. C. C. Koe, and D. K. Brady.
International Journal of Environmental Studies IJEVAW, Vol. 26, No. 3, p 223-229, 1986. 2 fig, 1 tab, 4 ref.

Descriptors: *Odor control, *Odor detection, *Pumping plants, *Wastewater facilities, Detection limits, Organoleptic properties, Field tests, Flow rates, Dilution-to-threshold concept.

Use of the dilution-to-threshold concept permits quantification of the odor concentration of ambient air in terms of standard odor units per unit volume. Taking into account the rate of odorous air emission from a sewage pumpstation, the odor source strength of the station can be conveniently expressed in terms of standard odor units per unit time. Field measurements were taken at 10 sewage pumpstations; odor emission rates were found to increase with the 1.3 power of the sewage flowrate. Thus, the potential odorousness of a sewage pumpstation is dramatically increased with increasing flowrates. However, because the magnitude of change in odor intensity observed by the human nose is logarithmically related to the magnitude of the odor concentration, perceived odor intensities in the neighborhood of pumpstations that received increased flowrates increase less dramatically than actual odor concentrations. (Rochester-PTT)
W87-03029

INDIRECT ATOMIC ABSORPTION DETERMINATION OF ANIONIC SURFACTANTS IN WASTEWATERS BY FLOW INJECTION CONTINUOUS LIQUID-LIQUID EXTRACTION,
Cordoba Univ. (Spain). Dept. of Analytical Chemistry.
For primary bibliographic entry see Field 5A.
W87-03048

INNOVATIVE LAGOON LINER PAYS OFF,
Greiner Engineering, Inc., Denver, CO.
B. E. Bauer, and C. P. Jepsen.
Public Works PUWOAH, Vol. 117, No. 8, p 42-43, August 1986.

Descriptors: *Wastewater lagoons, *Construction, *Linings, *Sodium bentonite, *Polymers, Sandstone, Siltstone, Cost analysis, Wastewater facilities, Volclay, Glendo, Wyoming, Soil properties.

Attempts to construct a series of non-discharging wastewater treatment lagoons for the community of Glendo (Wyoming) encountered difficulties when a layer of heavily cemented sandstone, which made building the originally conceived liner for the 68,000-sq ft lagoon impossible without a large increase in costs. The problem was solved by an innovative mixng and placment method in which polymer-treated sodium bentonite (Volclay SG-40 of American Colloid Company) was mixed with screened native soils in a pug mill to create a high-performance liner for which the company was willing to offer a 2-yr guarantee. Besides allowing for a more cost-effective use of bentonite, the pug mill approach permits use of a 'problem' native soil (cemented siltstone fragments) to be used in a liner, with considerable saving in construction costs. (Rochester-PTT)
W87-03078

PROFESSIONAL TANK CLEANING CAN MAKE A DIFFERENCE,
Metro East Sanitary District, Granite City, IL.
W. Greathouse.
Public Works PUWOAH, Vol. 117, No. 8, p 66, August 1986.

Descriptors: *Digester tanks, *Wastewater facilities, *Tank cleaning, Economic growth, Granite City, Illinois, Maintenance, Cleaning.

Cleaning digester tanks at the Metro East Sanitary District's primary treatment plants (Granite City, Illinois) was requiring too much time and some overtime for the regular maintenance crew of six. A cleaning contractor completed one project in just 5 days by using and experienced crew and special trash pumps. Economic growth in the service area had stagnated due to the need for additional treatment capacity. Professional cleaning of the digesters solved the immediate problem of inadequate capacity, buying time for completion of new facilities. (Rochester-PTT)
W87-03080

DETERMINATION OF HALOGENATED SOLVENT RESIDUES IN WATER, WASTE WATER, FEEDING-STUFFS, AND FOOD, (BESTIMMUNG HALOGENIERTER LOSUNGSMITTEL-RUCKSTANDE IN WASSER, ABWASSER, FUTTER- UND LEBENSMITTELN),
Lebensmittelversuchsanstalt, Vienna (Austria). Forschungsinstitut der Ernaehrungswirtschaft.
For primary bibliographic entry see Field 5A.
W87-03086

EFFECT OF EFFLUENT RECIRCULATION ON THE PERFORMANCE OF A TWO STAGE ANAEROBIC PROCESS,
Orange Free State Univ., Bloemfontein (South Africa). Dept. of Microbiology.
W. A. Joubert, T. J. Britz, and P. M. Lategan.
Biotechnology Letters BILED3, Vol. 7, No. 11, p 853-858, November 1985. 6 fig, 2 tab, 13 ref.

Descriptors: *Wastewater treatment, *Anaerobic digestion, *Effluents, *Fixed film reactors, *Upflow sludge blanket reactor, *Acidogenic reactors, *Chemical oxygen demand, *Wastewater treatment facilities, Suspended solids, Hydrogen ion concentration, Recirculation, Performance evaluation.

A two-stage anaerobic process using anaerobic hybrid reactors, in which a fixed film and an upflow sludge blanket reactor were combined to treat synthetic sucrose substrate, had a total chemical oxygen demand (COD) reduction of 78.5% at a space loading rate of 23.6 g/liter day. Recirculation of the pH-adjusted acidogenic phase effluent increased the COD reduction to 85.6% at a space loading rate of 27.1 g/l day in the reactor. With recirculation the suspended solids in the final effluent increased to 250 mg COD/l. (Author's abstract)
W87-03088

COGEN SYSTEM FIRES 100% UNTREATED DIGESTER GAS,
J. Makanski.
Power POWEAD, Vol. 130, No. 9, p 120, 122, September 1986. 4 fig.

Descriptors: *Wastewater treatment facilities, *Cogeneration, Sludge digestion, Energy conversion, Environmental effects, Denver, Computers, Performance evaluation.

Joining the ranks of wastewater treatment plants that have achieved energy efficiency through cogeneration is the Metropolitan Denver Sewage Disposal District No. 1. Last year the facility started up a cogeneration system, consisting of four engine/generator sets firing 100% digester gas - with no upstream gas-cleanup equipment. Heat content of the fuel is between 600 and 650 Btu/scf. Natural gas is burned only to start the engines during power blackout. Each engine is a turbocharged, spark-ignited, 12-cylinder unit running at 900 rpm and coupled to a 1200-kW synchronous generator. An electromechanical governor controls each engine/generator set. The control system includes isochronous load-sharing capability for precise load control when operating parallel with, or independent of, the utility grid. Burning untreated digester gas has presented a few difficulties. During system startup, for example, spark plugs lasted about 24 to 72 hours, far short of the expected two months. Hydrogen sulfide in the digester gas corrodes the electrodes causing the engine to misfire and cutting short spark-plug life. Following lengthy trials, engineers found that special aviation-type plugs made of platinum alloy gives satisfactory performance. They believe that runs of up to 2000 hours will now be possible before replacement. Moisture in the fuel has also caused problems. Water vapor carried over from the digesters tends to drop out as liquid following compression and sometimes cannot be removed fast enough in the separators. This causes sludge buildup and plugging problems in downstream equipment and engine components. Future plans at the treatment plant include optimizing the electric power production with respect to fuel-gas production in the digesters. Idea here is to control the anaerobic digesters so that the maximum amount of gas is available to the engines at those hours when the buyback rates for the power are the highest. Note that the contract with the local utility includes capacity- and energy-payment components. To this end, engineers at the site are correlating important process parameters - mass-detention time, temperature, sludge volatiles content, alkalinity, and primary-sludge/waste-activated-sludge ratio - to gas production. Presently, the cogeneration control system is being linked up to the process computer. (Alexander-PTT)
W87-03116

GETTING YOUR MONEY'S WORTH FROM COMPUTER BASED CONTROL SYSTEMS - PART 1,
Universal Engineering Corp., Boston, MA.
W. J. Shirreff.
Public Works PUWOAH, Vol. 117, No. 9, p 106-108, September 1986. 4 fig.

Descriptors: *Wastewater treatment facilities, *Computers, *Process control, Data processing.

Computer based control systems for wastewater treatment facilities can exceed $1 million in cost. The main objectives are to create a control system that increases operational efficiency and that encourages system use by operators with minimal

training and expertise. These objectives are attained through a design with features that create a user-friendly system, and contract specifications that will produce those features. The usefulness of certain control system features and some of the concerns and difficulties encountered in implementing them were discussed. Features to facilitate plant operations include: process mimic graphics, logs, trending and graph generation, alarm handling, maintenance management, and control. Operator preferences may require additional system features. Video copies of graphics, trends and graphs are useful. Remote communications through a modem can access data files on other computers, and can be used by the vendor during startup to make corrections to system programming. Compilers for FORTRAN and BASIC facilities to run business software can be added, but a microcomputer may be a more cost-effective approach to providing these features. (Alexander-PTT)
W87-03120

PUMP STATION'S COST REDUCED DRAMATICALLY,
San Francisco Dept. of Public Works, CA.
R. L. Moy, and A. J. Rando.
Public Works PUWOAH, Vol. 117, No. 9, p 121-123, September 1986.

Descriptors: *Pumping plants, *Wastewater treatment facilities, San Francisco, *Cost analysis, Design criteria, Pumps, Wastewater, Storage capacity.

Scheduled for operation in 1986, San Francisco's Westside Pump Station will rank among the world's most versatile sewage pumping stations. By designing the station to accommodate submersible pumps, the city's designers were able to cut the cost of the pump station by $7 million since the submersible pumps are installed directly in the wet well eliminating the necessity for a separate pump room. Following the city's topography, the sewage system is divided into two cores: the Bayside (along San Francisco Bay) and the Westside (along the Pacific Ocean). The major part of the Bayside System was completed in 1982. It includes a dry weather treatment plant with secondary treatment, a wet weather treatment plant, two large pump stations, and five miles of transport/storage sewers. The transport sewers not only convey the dry weather flows, but can store 70 MG during wet weather for treatment after a storm subsides. The Westside System, scheduled for completion in 1986, will reduce the number of overflows onto the beaches to only eight per year, a reduction of 86 percent. The system is designed to handle a wide variety of flow conditions, and will consist of five major elements: (1) an existing 45-mgd Richmond-Sunset Water Pollution Control Plant (RSWPCP); (2) a new 2-mile long Westside Transport (WST) line used for wet weather storage and transport; (3) two new 2-mile long pipelines - one a 54-in. gravity line, the other a 42-in. force main; (4) a new 12-ft diameter 4 1/2-mile long Southwest Ocean Outfall (SWOO); and (5) a new Westside Pump Station. When completed, the Westside System will perform several functions. During dry weather, the RSWPCP will handle all the flows and discharge its effluent through the 54-in. gravity line to the ocean outfall. During wet weather, a rainfall of 0.02 in. per hour or more, together with the normal dry weather flow, will produce an influent exceeding the 45-mgd capacity of the RSWPCP. Under this condition, the excess quantity will flow into the WST. (Alexander-PTT)
W87-03121

FLOW EQUALIZING SAVES TIME AND MONEY,
J. R. Ubel.
Public Works PUWOAH, Vol. 117, No. 9, p 128-130, September 1986.

Descriptors: *Flow control, *Wastewater treatment facilities, Equalizing tanks, Menomonie, Design criteria, Computers, Process control, Wastewater treatment.

Flow equalization - a method that plant engineers and managers sometimes overlook - solved the city of Menomonie's (WI) problem of high daily, short duration peak flows in its wastewater treatment plant. Installing an equalization basin is not a practical application for large plants or facilities with extensive collection systems that naturally provide substantial equalization of flow. However, for smaller and medium size plants with large diurnal flow variations, it can provide many benefits and allows full utilization of plant capacity. It may even be beneficial to incorporate flow equalization into new plant design rather than enlarge the total project to accommodate peak flows if wide swings in daily flows are anticipated. The wastewater treatment plant underwent major reconstruction 11 years ago that increased its capacity to 2.88 mgd and added full secondary treatment. The plant utilizes a wide spectrum of treatment processes: mechanical screening, primary settling, trickling filter, activated sludge, anerobic digestion, aerobic digestion, flotation thickening, and mechanical digested sludge thickening. Design criteria were established. Inorganics had to be eliminated prior to the tank and organic settling in the tank was to be minimized. Aeration had to be provided to eliminate septicity and proved pre-aeration and mixing while the flow and tank bottom design had to sweep accumulating solids to the outlet. Operation of the system was to be fully automatic, and cost kept to a minimum. These were the general considerations in addition to the many specific design problems. The facility can now accommodate peak flows of 4 mgd and utilize the full 2.88 mgd process capacity, with a system that is easier to operate. This was accomplished at a cost of 15 percent to 20 percent of the next least costly alternative. (Alexander-PTT)
W87-03124

FUNCTIONAL DESIGN OF ACTIVATED SLUDGE PROCESSES WITH HEAVY METAL INHIBITION,
Quebec Univ., Sainte-Foy.
R. D. Tyagi, D. Couillard, and J. P. Villeneuve.
Canadian Journal of Chemical Engineering CJCEA7, Vol. 64, No. 4, p 632-638, August 1986. 8 fig, 1 tab, 23 ref. Natural Sciences and Research Council (Canada) Grants A3711, A4984.

Descriptors: *Design criteria, *Activated sludge process, *Heavy metals, *Inhibition, Kinetics, Mathematical equations, Model studies, Recycling, Process control, Effluents, Biokinetics, Concentration.

A kinetic model that includes biokinetic and metal inhibition constants was developed to quantify the effects of metal inhibition and its effects on bioreactor design and process control strategy. The major engineering controls available to address the metal inhibition problems were mean residence time, recycle ratio and cell concentration in the recycle stream. These controls when combined with influent metal and substrate concentration determine the specific growth rate and effluent substrate concentration. It is important to examine both the biokinetic and metal inhibition constants for a specific waste in applying this model. (Michael-PTT)
W87-03131

IDENTIFICATION OF PROMISING CONCEPTS FOR TREATMENT OF CONTAMINATED SEDIMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
N. R. Francingues.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 162-185, 8 fig, 5 tab, 13 ref.

Descriptors: *Water pollution treatment, *Waste treatment, *Sediment contamination, *Physicochemical treatment, *Chemical treatment, *Biological treatment, Adsorption, Sedimentation, Filtration, Aerobic treatment, Anaerobic digestion, Sludge digestion.

Because of the nature and extent of contamination associated with sediments along our highly developed waterways and harbors, many of the sediments being dredged in maintenance projects are unsuitable for disposal by conventional methods. In some cases, these sediments are highly contaminated and have been identified as part of Superfund clean-up projects. Examples include Commencement Bay, Washington; Waukegan Harbor, Illinois; and New Bedford Harbor, Massachusetts. In such cases, the dredging operation may require novel approaches to the treatment and disposal of highly contaminated bottom sediments. Treatment processes discussed are: (1) Physical treatment (organic phase separation, solids settling and solids filtration); (2) Chemical or physical/chemical treatment (pH adjustment, chemical coagulation, carbon adsorption, air stripping, steam stripping and resin adsorption); (3) Biological treatment (aerobic suspended growth, aerobic fixed film and anaerobic); and (4) Residuals treatment or supporting processes (sludge digestion, thickening/dewatering, chemical recovery/reuse and incineration). (See also W87-03248) (Lantz-PTT)
W87-03256

DEWATERING OF BOTTOM SEDIMENTS,
Science Univ. of Tokyo (Japan).
For primary bibliographic entry see Field 2J.
W87-03261

WASTEWATER TREATMENT BY SOIL,
Ministry of Construction, Tokyo (Japan). Seacoast Div.
T. Tanimoto.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 300-317, 6 fig, 5 tab.

Descriptors: *Wastewater treatment, *Soil treatment, *Sanitation, Odor control, Biological oxygen demand, Aeration, Suspended solids, Nitrogen, Phosphorus, Activated sludge, Nitrification.

A newly developed wastewater purification method using soil simultaneously solved the problems of clogging, sanitation, and foul odor, which were not solved in the past by the pit method, though treating the wastewater beneath the ground succeeded as well in the removal of nitrogen and phosphorus which are very difficult by other means. The treatment system consists of four steps, settling tank, circulating contact aeration tank, final sedimentation tank through biofilm, and trench. The settling tank is expected to remove about 30% of the BOD load through stagnating wastewater for more than 16 hr. The circulating contact aeration tank is expected to remove about 30% of the BOD load of inflow water and is designed to cope with 0.3 kg of the BOD load/cu m. This method is intermediate between biofilm and activated sludge. The final sedimentation tank through biofilm is set up primarily to remove suspended solids and improve the water quality in order to prevent clogging in the trench, which is the final step. The final trench is primarily to remove N, P, and BOD load. Results of tests using this system are: (1) T-N and NH4-N in the settling tank are higher than those of wastewater. This may be caused by the method of water sampling; (2) 70% of the T-N is removed--half of it is removed in the circulating contact aeration tank and the other half in the trench; (3) Nitrification is observed in the circulating contact aeration tank and the trench; (4) Phosphorus is almost totally removed in the trench; (5) 98% of the BOD load is removed. Most of it is removed in the circulating contact aeration tank and the trench; (6) Only the settling tank and the trench remove suspended solids; (7) In seasonal fluctuations, T-N and NH4-N show a high rate in winter and summer, but no large fluctuation is observed after the trench step; and (8) The removal ratio of phosphorus decreases in August and September. (See also W87-03248) (Lantz-PTT)
W87-03264

EFFECTIVENESS OF CAPPING IN ISOLATING DUTCH KILLS SEDIMENT FROM BIOTA AND THE OVERLYING WATER,

Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5G.
W87-03332

WASTEWATER ENGINEERING DESIGN FOR UNSEWERED AREAS,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5E.
W87-03339

5E. Ultimate Disposal Of Wastes

FINDING USES FOR SLUDGE,
Brown and Caldwell, Pleasant Hill, CA.
R. C. Aberley, and S. Berg.
The American City and County ACCOD3, Vol. 101, No. 6, p 38+, April 1986.

Descriptors: *Sludge utilization, *Sludge disposal, *Waste management, *Economic aspects, Sludge digestion, Sludge drying.

Sludge management programs are examined in terms of regulatory requirements for hazardous waste disposal. The economic aspects of alternative disposal methods are reviewed and several innovative sludge management programs are discussed. (Michael-PTT)
W87-02641

DETECTION AND STABILITY OF ENTERIC VIRUSES IN SLUDGE, SOIL AND GROUND WATER,
Kongelige Veterinaer- og Landbohoejskole, Copenhagen (Denmark). Dept. of Veterinary Virology and Immunology.
For primary bibliographic entry see Field 5B.
W87-02662

EXAMINATION OF THE PENETRATION OF ENTERIC VIRUSES IN SOILS UNDER SIMULATED CONDITIONS IN THE LABORATORY,
Kongelige Veterinaer- og Landbohoejskole, Copenhagen (Denmark). Dept. of Veterinary Virology and Immunology.
For primary bibliographic entry see Field 5B.
W87-02663

CHARACTERIZATION OF WATER USING COMBINED SEWER OVERFLOWS, (CARACTERIZATION DES EAUX USEES DE DEBORDEMENTS DE RESEAU UNITAIRE),
For primary bibliographic entry see Field 5B.
W87-02672

MICROBIAL POLYMERS IN THE AQUATIC ENVIRONMENT-I: PRODUCTION BY ACTIVATED SLUDGE MICROORGANISMS UNDER DIFFERENT CONDITIONS,
Vysoka Skola Chemicko-Technologicka, Prague (Czechoslovakia). Inst. of Water Technology and Environmental Protection.
For primary bibliographic entry see Field 5D.
W87-02694

MICROBIAL POLYMERS IN THE AQUATIC ENVIRONMENT-II: ISOLATION FROM BIOLOGICALLY NON-PURIFIED AND PURIFIED MUNICIPAL WASTE WATER AND ANALYSIS,
Vysoka Skola Chemicko-Technologicka, Prague (Czechoslovakia). Inst. of Water Technology and Environmental Protection.
For primary bibliographic entry see Field 5D.
W87-02695

IMPROVED METHOD FOR RECOVERY OF ENTERIC VIRUSES FROM WASTEWATER SLUDGES,
Health Effects Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5A.
W87-02710

CORRELATION OF METAL-ORGANIC FRACTIONS WITH SOIL PROPERTIES IN SEWAGE-SLUDGE-AMENDED SOILS,
West Virginia Univ., Morgantown. Div. of Plant and Soil Sciences.
R. F. Keefer, and R. N. Singh.
Soil Science SOSCAK, Vol. 142, No. 1, p 20-26, July 1986. 1 fig, 7 tab, 17 ref.

Descriptors: *Soil properties, *Metal organic fractions, *Sludge disposal, *Sludge utilization, *Land disposal, Metals, Cadmium, Chromium, Nickel, Zinc, Lead, Anaerobic digestion, Aerobic digestion, Mineralogy, Copper, Hydrogen ion concentration, Soil analysis, Soil chemistry.

Soil properties of seven northeastern U.S. soils were correlated with metal-organic fractions using an extractant to explain metal reactions in soils to which three sewage sludges had been added. Two anaerobically digested sludges, one of which had been pretreated with chlorine, and an aerobically digested sludge were mixed with the soils and incubated for one month. The extracts were fractionated on nonpolar, nonionic macroreticular and ion exchange resins into acid, neutral and hydrophilic and hydrophobic solute fractions and analyzed for Cu, Cd, Cr, Ni, Pb and Zn. Soil pH and the amounts of illite, chlorite and fine clay seemed most closely associated with Cd, Cr, Ni and Zn in the various fractions. This seemed to indicate that mineralogy was related to organometallic components in soils, but correlations were not significant for every fraction of every sludge used. One anaerobic sludge resulted in a positive correlation between soil pH and the amount of Zn associated with the hydrophobic base fraction and between total Ni and the amount of Ni associated with that fraction. The two other sludges showed no consistent significant correlation between soil properties and metal-organic fractions. This indicates a need for classifying sewage sludge. (Michael-PTT)
W87-02714

NITRILOTRIACETIC ACID IN SLUDGE-AMENDED SOIL: MOBILITY AND EFFECTS ON METAL SOLUBILITY,
Imperial Coll. of Science and Technology, London (England). Public Health Engineering Lab.
K. Garnett, P. W. W. Kirk, R. Perry, and J. N. Lester.
Environmental Pollution (Series B) EPSPDH, Vol. 12, No. 2, p 145-162, 1986. 6 fig, 2 tab, 37 ref.

Descriptors: *Nitrilotriacetic acid, *Sludge, *Topsoil, *Fate of pollutants, *Land disposal, *Heavy metals, *Solubility, Metals, Solutes, Sludge utilization, Soil columns, Soil contamination, Soil properties, Cadmium, Copper, Manganese, Nickel, Lead, Zinc.

Soil column studies were undertaken to determine the mobility of nitrilotriacetic acid (NTA) in agricultural topsoil and its effect on the solubility of Cd, Cu, Mn, Ni, Pb, and Zn following land application of sludge containing NTA. The total weight of NTA retained on the columns was greater than 99% of that applied, with the levels of leached NTA becoming undetectable after 56 days. The presence of NTA increased the solubility of all six metals studied, although the degree of solubilization varied with the individual metal, NTA dose, and sludge application rate. Such an effect may result in greater metal mobility in sludge-amended soils, with possible changes in availability to plants and/or groundwater contamination. (Author's abstract)
W87-02765

HUMAN VIRUSES IN SEDIMENTS, SLUDGES, AND SOILS,
Baylor Coll. of Medicine, Houston, TX. Dept. of Virology and Epidemiology.
For primary bibliographic entry see Field 5B.
W87-02768

LOW LEVEL RADIOACTIVE WASTE DISPOSAL--TECHNOLOGY AND PUBLIC POLICY,
E. M. Breiner.
Journal of Environmental Sciences, Vol. 29, No. 4, p 47-56, July-August 1986. 17 fig, 5 tab, 44 ref.

Descriptors: *Radioactive waste disposal, *Technology, *Public policy, *Political aspects, Environmental policy, Public opinion, Land disposal, Waste disposal, Radioactive wastes, Wastes, Underground waste disposal, Radioisotopes, Regulations, Legal aspects.

The disposal of low level radioactive waste (LLRW) is becoming a political issue. The problems with shallow land burial of LLRW in the recent past have indicated to the public that current technology is inadequate. Therefore, studies are concentrating on the use of alternate technologies. These technologies consist of below- and aboveground vaults, earth-mounded concrete bunkers, minded cavities, and augered holes. Each of these disposal concepts meets performance criteria for the disposal of LLRW. However, in each case, there are some performance criteria where the alternate disposal methods do not show any improvement over shallow land burial. A trade-off is then necessary between sociopolitical acceptance and technical performance. (Author's abstract)
W87-02775

MORE AWARENESS SOUGHT CONCERNING ROLE OF METALS IN POLLUTION,
For primary bibliographic entry see Field 5B.
W87-02791

SOIL POTENTIAL RATINGS FOR ONSITE WASTEWATER DISPOSAL,
Satterthwaite Associates, Inc., West Chester, PA.
D. P. Steele, G. W. Petersen, and D. D. Fritton.
Journal of Environmental Quality JEVQAA, Vol. 15, No. 1, p 37-44, January-March 1986. 3 fig, 5 tab, 18 ref.

Descriptors: *Soil potential rating, *Infiltration, *Percolation, *Wastewater disposal, *Soil science, *Soil properties, *Wastewater management, *Land use, Waste disposal, Land disposal, Regulations, Engineering, Costs, Construction costs, Maintenance costs, Economic aspects.

Soil potential rating systems have been applied to interpreting soil suitabilities for onsite wastewater disposal in several regions. A procedure for generating such ratings for onsite residential wastewater disposal was applied to every soil mapping unit (91) in Potter Township, Centre County, PA. These ratings were developed by selecting the most appropriate onsite disposal technology using the following seven properties: depth to bedrock, depth to fragipan, depth to seasonally high water table, soil percolation time, slope, surface stoniness, and landscape position. An appropriate disposal system was selected for each mapping unit, following state regulations wherever possible; innovative designs were developed for all other cases. Costs of construction and maintenance were estimated for the best and worst case examples of each soil mapping unit, with dollar costs indexed over a range of 0 to 106. These numbers were later grouped into five soil potential classes according to the frequency of index rating values and an error estimation. Ratings were compared with the performance of onsite systems on four of the rated soil mapping units. Comparison indicated that the ratings were appropriate, allowed the numerical rating of every soil mapping unit, and could be used as a land use planning tool. (Author's abstract)
W87-02860

EFFECT OF SOIL AND EFFLUENT CHARACTERISTICS ON PHOSPHORUS SORPTION IN DOSED COLUMNS,
British Columbia Ministry of Environment, Victoria.
For primary bibliographic entry see Field 2G.
W87-02861

RESPONSE OF LETTUCE CULTIVARS TO SLUDGE-AMENDED SOILS AND BED TYPES,

Wisconsin Univ.-Madison. Dept. of Horticulture.
For primary bibliographic entry see Field 3C.
W87-02880

TRICKLE IRRIGATION SYSTEM FOR RECYCLING RESIDENTIAL WASTEWATER ON FRUIT TREES,
Great Lakes Irrigation Ltd., Hart, MI.
For primary bibliographic entry see Field 3C.
W87-02955

EFFECT OF WAVES ON BUOYANT JETS,
Memorial Univ. of Newfoundland, St. John's. Faculty of Engineering and Applied Science.
For primary bibliographic entry see Field 5B.
W87-02964

HAZARDOUT WASTE DISPOSAL: WHAT ARE THE OPTIONS,
Texas A and M Univ., College Station. Dept. of Soil and Crop Sciences.
K. W. Brown.
Grounds Maintenance, Vol. 21, No. 2, p 84+, February 1986.

Descriptors: *Pesticides, *Wastewater disposal, *Cleanup, Adsorption, Land disposal, Filtration, Evaporation, Soil disposal fields.

Because many of the commonly used pesticides are on the EPA list of toxic substances, all surplus spray solutions, container rinsate water, spray equipment rinsate, solutions resulting from spill cleanup, and misformulated solutions are hazardous wastes and must be dealt with in safe, approved methods. There are several things that can be done to reduce the amount of waste: (1) Mix only the amount of pesticide needed so there is little excess. (2) Have areas available where any excess mixed pesticide can be applied at the recommended rates. (3) Collect the excess solution plus the rinse water, and hold it in tanks to be used as make-up water when the next solution is made. Because the major component of the waste is water and because the pesticides in use today are degraded by soil microorganisms, evaporative pits or enclosed soil diposal beds may be considered. A final option is to use an enclosed bed of soil in a container above the soil surface to evaporate the water and degrade the pesticide. Containerized soil disposal systems have been used succesafully at the Iowa State University research farm for more than a decade. Although there is still more to be learned, it seems as if aboveground soil disposal beds may provide environmentally safe and economical means of pesticide solution, rinse and wash water disposal. (Alexander-PTT)
W87-03015

IMPACT OF CHEMICALLY CONTAMINATED SEWAGE SLUDGE ON THE COLLARD ARTHROPOD COMMUNITY,
Cornell Univ., Ithsca, NY.
For primary bibliographic entry see Field 5C.
W87-03081

EVALUATION OF EFFLUENT FROM GRASS SILAGE AS A FEED FOR BEEF CATTLE OFFERED SILAGE-BASED DIETS,
Agricultural Research Inst. of Northern Ireland, Hillsborough.
R. W. J. Steen.
Grass and Forage Science GFSCDW, Vol. 41, No. 1, p 39-45, March 1986. 4 tab, 24 ref.

Descriptors: *Grass silage, *Effluents, *Feed, *Beef cattle, *Feedlot wastes, Organic matter, Nutrition, Digestion, Steers, Silage, Dry matter, Cost analysis.

Four experiments were carried out to evaluate effluent from grass silage as a feed for beef cattle. Castrated male cattle (steers) with mean initial live weights of 380, 460, and 400 kg (Experiments 1-3) were offered effluent in addition to a diet of grass silage given ad libitum and supplemented with cereal-based concentrates. The cattle readily consumed effluent in preference to fresh water, the mean intake over the three experiments being 12.7 l per head, containing 0.77 kg dry matter (DM). Supplementation with effluent did not affect silage DM intake and increased total DM intake by 10%. Digestible energy concentrations of 13.1 and 16.6 MJ/kg DM and organic matter, respectively, in experiment 4, in which 8 steers of 295 kg mean live weight were fed. Fresh or well-preserved stored effluent from grass silage is readily consumed by beef cattle, is of high nutritive value, and could enable savings to be made in total feed costs. (Author's abstract)
W87-03099

MANURIAL VALUE OF SEPTIC-TANK SLUDGE ON GRASSLAND,
Water Research Centre, Medmenham (England). Medmenham Lab.
C. H. Carlton-Smith, and E. G. Coker.
Grass and Forage Science GFSCDW, Vol. 40, No. 4, p 411-417, December 1985. 11 tab, 13 ref.

Descriptors: *Manure, *Fertilizer, *Grasslands, *Sludge utilization, *Septic sludge, *Barley, Nitrogen, Phosphorus, Potassium, Land application, Plant physiology, Septic tanks, Sludge solids, Field tests, Heavy metals.

A field trial investigated the value of N, P, and K contained in septic-tank sludge and applied over a 3-yr period to grassland. The approximate amounts of nutrients that became available to ryegrass as inorganic fertilizer nutrients, when slude was applied at 4 t/ha, were: 67 kg N/ha, 57 kg P2O5/ha, and 34 kg K2O/ha. Barley grown in the 4th yr, when no sludge was applied, showed a significant response to the residual sludge N and P remaining in the soil. Septic-tank sludge apparently can supply useful amounts of N and P, and, unlike other forms of sewage sludge, significant quantities of K to grassland. Estimates of the nutrient value should be based on analysis of dry solids and total N, P, and K. Septic-tank sludge is usually low in metal content and no metal contamination problems should arise from land application. (Rochester-PTT)
W87-03102

CONSTRUCTING A BETTER ENVIRONMENT,
For primary bibliographic entry see Field 5G.
W87-03126

MIXED-CULTURE MICROBIAL PROTEIN FROM WASTE SULFITE PULPING LIQUOR II: ITS PRODUCTION ON A PILOT-PLANT SCALE AND USE IN ANIMAL FEED,
Quebec Univ., Trois-Rivieres. Centre de Recherche en Pates et Papiers.
S. N. Lo, and J. R. Moreau.
Canadian Journal of Chemical Engineering CJCEA7, Vol. 64, No. 4, p 639-646. 1 fig, 9 tab, 7 ref.

Descriptors: *Waste recovery, *Microbial degradation, *Sulfite liquors, *Feeds, *Pilot plants, Process control, Fermentation, Productivity, Biomass, Chickens, Pulp wastes, Biomass, Nutrients, Performance evaluation.

A pilot plant system to produce mixed-culture, high protein biomass from waste sulfite pulping liquor for animal feed was developed to determine whether enough sterlized biomass could be produced for large scale feeding studies, identify operational and control problems, adjust previouly established fermentation conditions to maximize productivity and verify the nutritive value and quality of the biomass produced at this scale. Pilot plant equipment and performance of the production process were described. Results of chicken feeding tests were reported and it is concluded that at least 50% of the soybean protein in a commercial diet could be replaced with biomass protein with no adverse effects on animal growth, health status or the organoleptic quality of chicken meat. (Michael-PTT)
W87-03132

GEOCHEMICAL AND ENVIRONMENTAL PROCESSES AFFECTING RADIONUCLIDE MIGRATION FROM A FORMERLY USED SEEPAGE TRENCH,
Oak Ridge National Lab., TN. Environmental Sciences Div.
C. R. Olsen, P. D. Lowry, S. Y. Lee, I. L. Larsen, and N. H. Cutshall.
Geochimica et Cosmochimica Acta GCACAK, Vol. 50, No. 4, p 593-607, April 1986. 5 fig, 11 tab, 46 ref. DOE Contract DE-AC05-84OR21400.

Descriptors: *Geochemistry, *Radioactive wastes, *Seepage pits, *Migration, Soil contamination, Alkalinity, Sorption, Plutonium, Radioactive waste disposal, Groundwater, Precipitation, Leaching, Bedrock, Geologic fractures, Seasonal variation.

Liquid wastes which contained activation products, actinides and transuranics and which were disposed in a shallow land seepage trench were studied to investigate factors affecting contaminant migration in soils and weathered bedrock. Most waste liquids seeped along discrete layers parallel to bedding and along the strikes of faults and folds. Groundwater radioactivity consisted of 3H, 99Tc, 60Co, and 233U. Groundwater 90Sr and 137Cs concentrations were low because of precautions taken to establish and maintain an alkaline environment near the trench which allowed for 90Sr sorption and precipitation and because 137Cs had a strong tendency to be selectively sorbed by illite. Plutonium isotopic ratios indicated that contamination was caused by 242Cm and 244Cm migration and their subsequent decay to 238Pu and 240Pu. Radionuclide concentrations near the north end of the trench experienced seasonal variations with the highest activities occurring in the spring and after prolonged rainfalls. This contamination may be leached from the trench or from relict waste migration layers when groundwater levels saturate these zones or when precipitation infiltrates the trench or travels along relict migration layers during drainage. Suspected transport pathways from the trench to a nearby seep area appear to be associated with fault zones and limbs of a plunging limestone fold. (Author's abstract)
W87-03135

EVALUATION OF THE FACTORS GOVERNING THE MOBILITY OF DREDGED MATERIAL PLACED AT OPEN WATER DISPOSAL SITES,
Connecticut Univ., Groton. Marine Sciences Inst.
W. F. Bohlen.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 85-100, 9 fig, 5 ref.

Descriptors: *Dredging, *Path of pollutants, *Ocean dumping, *Waste disposal, Waste management, Estuaries, Evaluation, Temporal distribution, Transmissivity, Temperature, Conductivity, Electromagnetic waves, Water sampling, Long Island Sound, Sediments.

Long-term management of open water disposal areas receiving dredged material, requires and understanding of the physical and biological factors affecting local sediment transport. Within most continental shelf, nearshore, and estuarine areas these factors display a high degree of temporal variability with the majority of significant sediment displacements occurring during aperiodic storm events. The short-lived nature of these events establishes particular sampling constraints, and favors the use of in-situ systems to monitor transport-related processes. To satisfy these constraints a bottom-mounted instrumentation array has been developed and deployed. The array contains optical transmissometers to monitor suspended material concentrations, temperature-conductivity probes, an electromagnetic current meter, a wave gage, a lapsed-time camera and strobe system, and a sequenced mechanical water sampler. The entire system is controlled and the resultant data recorded by a digital data logger. The unit is capable of unattended operation for periods in excess of 30 days at sampling rates of four scans of the entire array each hour. Reviews of selected data obtained at several locations within Long Island Sound reveal a range of high and low

frequency variations in sediment movements. Low frequency variations appear to be primarily the result of biologically mediated factors, while the higher frequency components occur in response to persistent tidal forcing and aperiodic storm events. The latter displacements appear to be nonlinear in character and not simply related to storm intensity. In addition to these temporal characteristics, array observations indicate evident spatial variability associated primarily with sediment characteristics and the presence or absence of near-bottom fluff layers. These layers of organic-mineral aggregates appear to modify the structure of the flow field affecting the sediment-water interface and may serve to limit erosion and transport. Determination of the dynamics associated with these layers required consideration of the role of the overlying water column as a source of materials to the near-bottom areas. A system sufficient to provide these observations is outlined. (See also W87-03248) (Author's abstract)
W87-03252

ECOLOGICAL EVALUATION OF ORGANO-TIN-CONTAMINATED SEDIMENT,
Naval Ocean Systems Center, San Diego, CA. Environmental Sciences Div.
For primary bibliographic entry see Field 5B.
W87-03254

PARTIAL REVIEW OF DREDGED MATERIAL DISPOSAL TECHNIQUES,
Nishiki Consultant Co. Ltd., Tokyo (Japan).
H. Koba, and M. Miyake.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./ Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 222-236, 14 fig, 17 ref.

Descriptors: *Waste disposal, *Spoil disposal, *Sedimentation, Dredging, Sediments, Mathematical analysis, Consolidation sedimentation, Field tests, Japan.

Coastal disposal areas containing dredged sediments contaminated with hazardous material are not easily reclaimed into stable land areas. The techniques for predicting the period required for disposed material to become stable through sedimentation and self-weight consolidation have progressed, but are not yet satisfactory. This paper reviews the following techniques for predicting sedimentation and self-weight consolidation of disposed sediment in Japan: (a) prediction of surface settlement due to sedimentation and self-weight consolidation, and (b) consolidation tests to obtain the input data for the numerical consolidation analysis. A site application example is also given. (See also W87-03248) (Lantz-PTT)
W87-03259

LIME-CEMENT HARDENING OF VERY SOFT FRESHWATER CLAY,
Kyoto Univ. (Japan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8D.
W87-03260

SELECTION AND MANAGEMENT OF A NEW ORLEAN DREDGED MATERIAL DISPOSAL SITE AT COOS BAY, OREGON, USA, TO RECEIVE CONTAMINATED DREDGED MATERIAL,
Army Engineer District, Portland, OR.
J. R. Reese.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./ Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 277-299, 13 fig, 11 ref.

Descriptors: *Dredging, *Waste disposal, *Spoil disposal, *Coos Bay, Oregon, Waste management, Management, Environmental protection, Portland, Data interpretation.

Ocean disposal of dredged material on the Pacific Northwest coast has, until recently, involved only clean, medium-grain-sized marine sands. Those sediments are dredged by hopper dredge and placed at approved interim ocean disposal sites in the littoral transport zone directly offshore from the estuary. The upper reaches of those coastal river systems are normally maintained by pipeline hydraulic dredges and the material placed at upland disposal sites. The material is a silt clay sediment, and in Coos Bay is considered slightly contaminated by existing Federal criteria. Upland sites are becoming extremely difficult to obtain and at Coos Bay, Oregon, all approved sites are nearly filled to capacity. The only alternative to upland sites is transporting material to the ocean. Portland District determined that upland sites at Coos Bay would be filled by the early 1980's, and in 1977 proceeded with long-term oceanographic studies for evaluating ocean disposal sites to accept fine-grained, slightly contaminated dredged material. The District recognized that the site and sediment must be in compliance with State and Federal regulations, especially the Marine Protection, Research, and Sanctuaries Act. Chemical, physical, and biological studies were conducted for 2 years on nearshore ocean environment and dredged sediments. The long-term nature of studies and the full range of tests conducted and modified for the Pacific Northwest Coast conditions have allowed for shorter term and less expensive tests to be conducted at the remaining Portland District ocean disposal sites. Evaluation studies are under way for eight remaining Portland District ocean disposal sites with comparisons made with the Coos Bay data. This has allowed for the eight remaining sites to be evaluated for less cost and time than the cost for the Coos Bay studies alone. (See also W87-03248) (Lantz-PTT)
W87-03263

PRINCIPLES AND PRACTICES FOR THE OCEAN DISPOSAL OF DREDGED MATERIAL: THE LONDON DUMPING CONVENTION RE-EXAMINED,
New Orleans Board of Commissioners of the Port, LA.
H. R. Haar.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./ Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 357-367.

Descriptors: *Ocean disposal, *Dredging, *London, Spoil disposal, Water pollution effects, Fate of pollutants, Path of pollutants, Legal aspects, Heavy metals.

Members of the International Association of Ports and Harbors (IAPH) and the American Association of Port Authorities (AAPA) have, since 1979, been actively engaged with various activities involving the London Dumping Convention. In response to the dumping of contaminated dredged materials, it has been necessary for IAPH and AAPA to engage the services of scientific and legal professionals to assist in examining and proposing viable solutions capable of bridging differences between ports' interests worldwide and those of the U.N. treaty organization. The results of this mission is to address past activities and current issues. The major conclusion drawn from this study indicates that in many instances the disposal of toxic dredged waste into the ocean should be the preferred alternative over any reasonable type of upland disposal. Some of the findings of this study which support this conclusion are as follows: (1) It is not sound to expect that a criterion for allocation of substances to the Annexes should routinely apply in an equal manner to a given toxicant when it is disposed into the ocean as a component of different wastes; (2) A waste per the Convention must be defined as the toxicant or toxicants of concern and the 'carrier' in which it is disposed; (3) The nature of the carrier plus the chemical species involved generally determine whether or not a toxicant will be available to the biota; (4) Marine sediments, especially of estuarine origin, characteristically contain clay minerals, such as montmorillonite and vermiculite, humic acids, and sulfides, all of which are effective at reducing the availability of toxic metals or synthetic organic compounds to the biota; (5) When because of the composition of the carrier a substance does not have bioavailability, there can be no absorption into the organisms' tissues. This physicochemical suite of carrier properties comprises the 'first line of defense' against environmental impacts; (6) Given that a toxicant is not bioavailable to marine plants or metazoan animals, it follows that attempts to apply the extent three criteria (toxicity, bioaccumulation, and persistance) are misguided and confusing; and (7) Even when trace amounts of a toxicant in a waste are bioavailable and have actually been absorbed they will evoke the second line of defense, which is physiological. (See also W87-03248) (Lantz-PTT)
W87-03267

PROGRESSIVE TRENCHING USING A SCRAPER DIGGER,
Kyoto Civil Engineering and Construction Dept. (Japan).
T. Inoue.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./ Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 368-379, 16 fig, append.

Descriptors: *Trenches, *Spoil disposal, *Waste disposal, Scrapers, Digging, Dewatering, Sedimentation, Stress, Stabilization.

The progressive trenching method developed in the United States is introduced. In the management of a disposal area in Tsu-Matsuzaka Harbor, the progressive trenching method was first applied in Japan to promote the dewatering of dredged material. In this case the digging of the trench was performed by a floating scraper. Water content 30 cm below the surface was 400% at the end of filling and 261% just prior to the first trenching. Water content decreased gradually as trenching advanced. The water content after 185 days was 149%. Consequently, as the result of trenching, a reduction in water content of 43% was attained. Water content at a point 30 m away from a trench was approximately equal to the water content at a point near the trench in shallow trenching. However, as the depth of the trench progressed, the water content became lower at the point near the trench and increased proportionally with distance. Settlement after 185 days in 18 cm. The mean settling rate is about 0.15 cm/day. The cone penetration stress was 0.25 kg/sq cm at the beginning and increased to 0.66 kg/sq cm by the 5th trenching and finally to 0.9 kg/sq cm. This means that in this case the filled area has stabilized well. (See also W87-03248) (Lantz-PTT)
W87-03268

FEASIBILITY OF USING MYCORRHIZAL FUNGI FOR ENHANCEMENT OF PLANT ESTABLISHMENT ON DREDGED MATERIAL DISPOSAL SITES: A LITERATURE REVIEW,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 3D.
W87-03316

WASTEWATER ENGINEERING DESIGN FOR UNSEWERED AREAS,
Connecticut Univ., Storrs. Dept. of Civil Engineering.
R. Laak.
2nd Edition. Technomic Publishing Co., Lancaster, Pennsylvania. 1986. 171 p.

Descriptors: *Land disposal, *Land treatment, *Wastewater disposal, *Cesspools, *Design standards, *Wastewater treatment, *Septic tanks, Engineering, Mounds, Filtration, Waste disposal.

Low-cost onsite wastewater disposal systems can now be considered as permanent solutions to the problem of waste removal; no longer are they regarded as temporary measures to be used only until sewers are built. The required engineering steps are outlined here for simple as well as difficult site conditions. Innovative, alternative, and new systems, such as mounds, different sand filters, the RUCK system, and the indrains for reduced seepage fields, are presented in detail. The book

can be used for planning, design, repairs, and alterations. Chapter topics are: (1) site investigation; (2) characteristics and quantity of wastewater; (3) pretreatment methods; (4) subsruface soil systems; (5) septage disposal; and (6) design examples or guides. (Lantz-PTT)
W87-03339

5F. Water Treatment and Quality Alteration

TRIHALOMETHANE LEVELS IN CHLORINATED MICHIGAN DRINKING WATER,
Michigan State Univ., East Lansing. Inst. of Water Research.
E. A.-N. Furlong, and F. M. D'Itri.
Ecological Modelling, Vol. 32, No. 1-3, p 215-225, June 1986. 1 fig, 3 tab, 17 ref.

Descriptors: *Raw water, *Drinking water, *Water quality, *Trihalomethanes, *Michigan, *Chlorination, Chloroform, Dibromoethane, Bromodichloromethane, Bromoform, Groundwater, Great Lakes, Hydrogen ion concentration, Mathematical models, Chemical treatment, Water treatment.

Raw and finished drinking water from 40 Michigan treatment plants was analyzed for total trihalomethane (TTHM) concentrations by the liquid-liquid extraction method. Concentrations in the samples ranged from undetectable to 281.8 microgram/liter (ug/l) with a mean of 44.0 ug/l and a median of 20.5 ug/l. Chloroform usually was present in the highest concentration, followed by bromodichloromethane, dibromomethane, and bromoform. After adjustment for the quantity of chlorine added, treated drinking water had significantly higher TTHM levels than either Great Lakes water or groundwater. When chlorinated, Great Lakes water tended to have higher TTHM levels than did groundwater. The best model developed to predict TTHM concentration was a two-variable one, as follows: TTHM = -13.5 + 22.24 (chlorine dose) + 2.38 x 10 to the 8th power (hydrogen ion concentration). The model can be used by treatment plant operators to predict TTHM levels within a given set of conditions. (Rochester-PTT)
W87-02605

MANAGING AN UNFILTERED WATER SUPPLY,
Seattle Dept. of Water, WA. Water Quality Div.
R. G. Donner, and J. C. Kirner.
Journal of the American Water Works Association JAWWA5, Vol. 77, No. 12, p 32-37, December 1985. 10 ref.

Descriptors: *Water supply, *Filtration, *Water quality control, *Disinfection, Trihalomethanes, Microbiological organisms, Turbidity, Physical properties.

Reasons for supporting a nationally mandated filtration can be responded to by a modification of operations or by the observation that the concern is not applicable to all water utilities. Water quality problems associated with turbidity include an inability to maintain a disinfectant residual and the sheltering of microbiological organisms--both of which lead to a decrease in the effectiveness of disinfection--as well as the contribution of turbidity to the formation of trihalomethanes. If the turbidity of the source water is made up primarily of inorganic materials, these concerns may not be a factor. It can be argued that resistant organisms cannot be killed by disinfection as normally practiced, but disinfection practices can be modified to provide satisfactory disinfection and deactivation of resistant organism under the proper circumstances. (David-PTT)
W87-02609

ASSURING ACCURATE MODEL CALIBRATION,
Corps of Engineers, Vicksburg, MS.
T. M. Walski.
Journal of the American Water Works Association JAWWA5, Vol. 77, No. 12, p 38-41, December 1985. 2 tab, 5 ref.

Descriptors: *Model calibration, *Water distribution, *Model testing, Meters, Pressure distribution, Calibrations, Models.

Water distribution system models are only as good as the data with which they are calibrated. Just comparing predicted and observed pressures during normal use cannot ensure accuracy. If an engineer is to have any confidence in the results of a water distribution system model, the model must be calibrated using high quality data. Just analyzing differences between observed and predicted pressures for a single loading is not an acceptable way to judge calibration accuracy. Techniques are available to collect and to use the data for calibration. There is no reason to settle for guesses or typical literature values as to C-factors, water use, and boundary heads for use in a model. Some tips for calibration include: conducting C-factor tests; checking pump operating points, checking pressure-reducing value settings; calculating use; checking master meters, and checking users' meters. (David-PTT)
W87-02610

SLOW SAND FILTRATION: INFLUENCES OF SELECTED PROCESS VARIABLES,
CH2M Hill, Newport Beach, CA.
W. D. Bellamy, D. W. Hendricks, and G. S. Logsdon.
Journal of the American Water Works Association JAWWA5, Vol. 77, No. 12, p 62-66, December 1985. 5 fig, 5 tab, 11 ref. EPA Cooperative agreement CR808650-02.

Descriptors: *Sand filters, *Coliform bacteria, *Wastewater treatment, *Water treatment, *Filtration, Water quality control, Economic aspects, Pilot plants, Cost analysis, Giardia cysts, Water purification.

Research was conducted to determine the influences of selected process variables on the treatment efficiency of slow sand filtration. The results indicate that slow sand filtration is an effective water treatment technology, as determined by removals of total coliform bacteria and Giardia cysts. Further, the process is passive in nature, requiring little maintenance on the part of the operator. This technology should be considered during the selection of a water treatment system. Pilot-plant testing should be done, however, to determine the technical feasibility of each alternative. Selection should be determined by economic analyses in addition to the appropriateness of the technologies for the community at hand. (David-PTT)
W87-02611

CHLORINATION TO PREVENT AND CONTROL WATERBORNE DISEASES,
Drexel Univ., Philadelphia, PA. Dept. of Biological Sciences.
E. C. Lippy.
Journal of the American Water Works Association JAWWA5, Vol. 78, No. 1, p 49-52, January 1986. 2 fig, 1 tab, 15 ref.

Descriptors: *Chlorination, *Waterborne diseases, *Disinfection, *Water quality control, *Water treatment, Bacteria, Pathogens, Temperature, Protozoans, Viruses, Chlorine, Hydrogen ion concentration.

Recent publications identified shortcomings in disinfection contributing to waterborne disease outbreaks. The primary problems sited were that disinfection was not provided where it was needed, and it was not properly operated where it was provided, both of which caused or contributed to nearly half of the outbreaks of waterborne disease in public water systems. The article reviews the factors that influence chlorine's effectiveness in inactivating bacteria, viruses, and protozoans for the purposes of preventing and controlling waterborne disease outbreaks. The factors reviewed are: chlorine concentration, contact time, pH, temperature, and interfering substances. Each must be evaluated to determine disinfection capability under current operating conditions and to determine the adjustments necessary for coping with the challenges of pathogens. (David-PTT)
W87-02613

ROTAVIRUS SURVIVAL IN RAW AND TREATED WATERS AND ITS HEALTH IMPLICATIONS,
Ottawa Univ. (Ontario). Dept. of Microbiology and Immunology.
For primary bibliographic entry see Field 5G.
W87-02644

DETECTION OF HEPATITIS A VIRUS (HAV) IN DRINKING WATER,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
For primary bibliographic entry see Field 5A.
W87-02646

DETECTION OF HEPATITIS A VIRUS IN DRINKING WATER BY ENZYME-IMMUNOASSAY USING ULTRACENTRIFUGATION FOR VIRUS CONCENTRATION,
Vienna Univ. (Austria). Hygiene Inst.
For primary bibliographic entry see Field 5A.
W87-02647

CONCENTRATION OF SEEDED AND NATURALLY OCCURRING ENTEROVIRUSES FROM WATERS OF VARYING QUALITY BY HOLLOW FIBER ULTRAFILTRATION,
Rensselaer Polytechnic Inst., Troy, NY. Dept. of Chemical and Environmental Engineering.
For primary bibliographic entry see Field 5A.
W87-02648

RECOVERY OF VIRUSES FROM DRINKING-WATER BY MEANS OF AN IN-LINE ELECTROPOSITIVE CARTRIDGE FILTER,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5A.
W87-02649

CONCENTRATION OF VIRUSES FROM WATER USING PIG ERYTHROCYTE GHOST CELLS,
Technion - Israel Inst. of Tech., Haifa. Dept. of Food Engineering and Biotectnology.
For primary bibliographic entry see Field 5A.
W87-02650

ELECTROFOCUSING OF VIRUSES AND SENSITIVITY TO DISINFECTION,
Surrey Univ., Guildford (England). Dept. of Microbiology.
For primary bibliographic entry see Field 5D.
W87-02664

STUDY OF INDIGENOUS VIRUS REMOVAL AT DIFFERENT STAGES IN A DRINKING WATER PLANT TREATING RIVER WATER,
Nancy-1 Univ. (France). Lab. d'Hygiene et de Recherche de la Sante Publique.
F. Agbalika, P. Hartemann, J. C. Joret, A. Hassen, and M. M. Bourbigot.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 211-218, October 1985. 1 fig, 4 tab, 17 ref.

Descriptors: *Performance evaluation, *Viruses, *Water treatment, *Drinking water, *Rivers, *Water treatment facilities, *Disinfection, Ozonation, Coagulation, Flocculation, Filtration, Sedimentation, Chlorination, Chlorine, Activated carbon, Carbon, Water analysis, Water quality management, Public health.

The virological efficiency of individual treatment processes was investigated in a plant which produces drinking water from water of the river Oise. The sequence of treatment processes was preozonation-storage-coagulation-flocculation-settling-sand

filtration-second stage ozonation-activated carbon filtration-post ozonation-chlorine dioxide. Nine series of samples were taken after various treatment stages and analyzed. Viruses were recovered by an absorption-elution method using electronegative or electropositive filters. BGM cells were used for virus detection, and all samples of raw water yielded positive results. Viral counts decreased by 89%, 77%, and 55% after intermittent preozonation and storage, settling, and sand filtration, respectively. No viruses were recovered from the water after the second stage ozonation. The subsequent post ozonation and final treatment with chlorine dioxide served as additional barriers to ensure a virologically safe drinking water supply. (Author's abstract)
W87-02665

DESIGN FACTORS FOR THE SCOURING OF DEPOSITED MATERIALS IN WATER AND WASTEWATER TREATMENT SYSTEMS,
Windsor Univ. (Ontario). Dept. of Civil Engineering.
D. W. Machina, and J. K. Bewtra.
Canadian Journal of Civil Engineering CJCEB, Vol. 12, No. 3, p 567-572. September 1985. 7 fig, 2 tab, 5 ref.

Descriptors: *Water quality, *Water treatment, *Wastewater treatment, *Sediments, Scour, Particle shape, Flow velocity, Suspended solids, Air circulation, Pumping.

Many water and wastewater systems require that sediments in the flow remain in suspension. Sometimes auxiliary power sources, such as compressed air, or pumping, are used to obtain scouring velocities within the system. The combined effects of pumping, compressed air, and gravity (floor slope) on the solid-liquid interaction and the velocity required to scour particles, are presented. Two nondimensional are developed to present data. Design curves for scouring sand, grit, and secondary sludge particles are presented and compared with data obtained for spherical particles. The particle terminal settling velocity is used to describe the significant particle characteristics. The use of prototypical particles and slopes, together with the dimensionless parameters, allows an application of results to prototype systems where auxiliary scouring sources may or may not be present. Using the information presented, it is possible to design water and wastewater systems in which particles must remain in suspension, with or without the use of auxiliary power sources. (Author's abstract)
W87-02674

RADIATION INDUCED DECOMPOSITION OF SOME CHLORINATED METHANES IN WATER,
Vienna Univ. (Austria). Dept. of Theoretical Chemistry and Radiochemistry.
For primary bibliographic entry see Field 5D.
W87-02702

INNOVATIVE TECHNIQUE FOR DETERMINING VELOCITY GRADIENT IN COAGULATION--FLOCCULATION PROCESS,
National Environmental Engineering Research Inst., Nagpur (India). Water Engineering Div.
V. A. Mhaisalkar, R. Paramasivam, and A. G. Bhole.
Water Research WATRAG, Vol. 20, No. 10, p 1307-1314, October 1986. 5 fig, 2 tab, 14 ref.

Descriptors: *Velocity gradient, *Coagulation, *Water treatment, *Flocculation, *Filtration, Water quality, Surface water, Mixing intensity, Dimensional analysis, Impellers, Design criteria.

The importance of mixing intensity expressed as the mean velocity gradient in coagulation-flocculation processes is briefly reviewed. Available methods for determining power requirements for mechanical mixing devices, their relative merits and limitations and the usefulness of standard power curves are discussed. A simple, innovative, electrical method to measure power input to an impeller mixer has been developed which eliminates possible causes of error. Power curves have been derived for a turbine impeller for use with two container geometries. It has been shown that for a given impeller speed, the energy input increases depending upon the impeller- container system geometries in the following order: cylindrical without baffles; squares without baffles; cylindrical with baffles; and square with baffles. The power function for Reynolds numbers in the range 10000-45000 varies from 1.96- 0.512 and from 3.43-1.83 for clyindrical and square containers, respectively. The results compare very well with those obtained by others and the method can provide a valuable tool for design, development and optimization of mixing devices for coagulation-flocculation in water treatment. (Alexander-PTT)
W87-02708

APPLICATION OF ALUMINAS IN WATER TREATMENT,
Aluminum Co. of America, Alcoa Center, PA. Alcoa Labs.
For primary bibliographic entry see Field 5D.
W87-02752

USE OF ULTRAVIOLET LIGHT IN THE TREATMENT OF WATER IN PUBLIC SPAS AND HOT TUBS,
R. A. Crandall.
Journal of Environmental Health JEVHAH, Vol. 49, No. 1, p 16-23, July-August 1986. 3 fig, 6 tab, 18 ref.

Descriptors: *Water treatment, *Recreation facilities, *Ultraviolet radiation, *Disinfection, *Performance evaluation, Public health, Chlorination, Hydrogen peroxide, Radiation, Health hazards.

Due to increasing concern about the effectiveness of chlorination as a sole method of sanitizing public spas and hot tubs, alternative methods such as ultraviolet light (UV) are being utilized. UV light in conjunction with hydrogen peroxide has been demonstrated to sanitize hot-water recreational environments effectively. The principles, parameters, and guidelines for operation of the UV-hydrogen peroxide process are presented, along with data from an extensive test conducted in the state of Oregon, where the UV-hydrogen peroxide process compared favorably with the chlorination process. At the same time, further research and development is needed, including technical improvements in monitoring and control equipment, more efficient unit designs and components, and better understanding of the kinetics involved in spa water chemistry and the process's photochemical reactions. Existing UV equipment could also be more appropriately designed and engineered to meet the needs and requirements of the spa/pool application. (Doria-PTT)
W87-02755

PREVENTION AND TREATMENT OF ENDEMIC IODINE-DEFICIENCY GOITER BY IODINATION OF A MUNICIPAL WATER SUPPLY,
Catania Univ. (Italy). Cattedra di Endocrinologia.
S. Squatrito, R. Vigneri, F. Runello, A. M. Ermans, and R. D. Polley.
Journal of Clinical Endocrinology and Metabolism JCEMAZ, Vol. 63, No. 2, p 368-375, August 1986. 2 fig, 4 tab, 20 ref.

Descriptors: *Iodine, *Goiter, *Drinking water, *Municipal water, *Public health, *Iodination, Human diseases, Diseases, Deficient elements, Nutrients, Cost analysis.

Introduction of iodine into a public water supply for the prevention and treatment of endemic iodine deficiency and goiter was tested in Troina, Sicily. Before initiation of the program, a goiter endemic of moderate severity was present, as evidenced by goiter prevalence of 55% in school children. Iodination of the water was followed by a prompt and marked reduction in goiter prevalence, and by improvement in biochemical indices of iodine deficiency. Overall goiter frequency in school children had declined to 6.1%, and large goiters had virtually disappeared. Iodinated water was well tolerated by the population, and no adverse effects, including increase in the frequency of hyperthyroidism, were observed. At present prices, the cost of the water iodination program in Troina would be approximately four cents (U.S.) per person per year. It is concluded that iodination of public water supplies is highly efficacious, safe, and cost-effective, affording promise in the prophylaxis and treatment of endemic iodine deficiency and goiter. (Author's abstract)
W87-02779

WATER SUPPLY IN DEVELOPING COUNTRIES: IMPROVING ON CURRENT PRACTICE,
For primary bibliographic entry see Field 5G.
W87-02784

APPLICATION OF ENVIRONMENTAL MANAGEMENT PRINCIPLES IN THE PROGRAM FOR ERADICATION OF AEDES (STEGOMYIA) AEGYPTI (LINNEUS, 1762) IN THE REPUBLIC OF CUBA, 1984,
Ministry of Public Health, Havanna (Cuba). National Aedes aegypti Eradication Campaign.
For primary bibliographic entry see Field 5G.
W87-02824

MODEL SIMULATION OF SOLUTE LEACHING AND ITS APPLICATION FOR ESTIMATING THE NET RATE OF NITRATE FORMATION UNDER FIELD CONDITIONS,
National Inst. for Environmental Studies, Tsukuba (Japan). Systems Analysis and Planning Div.
For primary bibliographic entry see Field 5B.
W87-02839

HYDRAULICS OF RECTANGULAR CLARIFIERS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
For primary bibliographic entry see Field 8B.
W87-02886

PRACTICAL DIRECT PLAQUE ASSAY FOR COLIPHAGES IN 100-ML SAMPLES OF DRINKING WATER,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 5A.
W87-02890

BACTERIA ASSOCIATED WITH GRANULAR ACTIVATED CARBON PARTICLES IN DRINKING WATER,
Montana State Univ., Bozeman. Dept. of Microbiology.
For primary bibliographic entry see Field 5B.
W87-02891

COMPARISON OF CLARK'S PRESENCE-ABSENCE TEST AND THE MEMBRANE FILTER METHOD FOR COLIFORM DETECTION IN POTABLE WATER SAMPLES,
Drexel Univ., Philadelphia, PA. Dept. of Civil Engineering.
For primary bibliographic entry see Field 5A.
W87-02892

MECHANISM OF INACTIVATION OF ENTERIC VIRUSES IN FRESH WATER,
James N. Gamble Inst. of Medical Research, Cincinnati, OH.
For primary bibliographic entry see Field 5B.
W87-02893

WATERLINE PROBLEMS CAN BE AVOIDED WITH CARE AND TESTING,
MEI-Charlton, Inc., Portland, OR.
For primary bibliographic entry see Field 8A.
W87-02904

PUMP STATION GETS NAVY DISCHARGE AND NEW LIFE AS CIVILIAN,
Tatman and Lee Associates, Wilmington, DE.
D. P. Lee, and P. C. D'Adamo.
Water Engineering and Management WENMD2, Vol. 133, No. 6, p 26-28,47, June 1986. 1 tab.

Descriptors: *Pump stations, *Water treatment facilities, *Maryland, *Port Deposit, Pumping plants, Water treatment, Hydraulic machinery, Design criteria, Operating costs, Cost analysis.

A decade of negotiations, planning design and construction for a small Maryland community culminated last summer in the completion of a novel water supply project, thereby ending the town's 40-year dependency on the U.S. Government to provide potable water services. Prior to the construction of the new water system, the town obtained potable water from the Department of Navy. The conditions of the water supply agreement were that the Navy was obligated to provide the services ad infinitum. However, the Navy's abandonment of the Bainbridge site in 1976, led to extremely high operating costs. The Navy agreed to pay Port Deposit $1.7 million to construct a new water treatment and storage system and $1.0 million to defray operational costs, and provide potable water to the Job Corps Center. A major design objective of the project was to achieve mechanical simplicity and low maintenance and operational costs. Evaluation of seven treatment systems resulted in the selection of a system manufactured by Parkson Corporation of Fort Lauderdale, Florida. A separate study was made to determine the best site for the new water treatment plant. Storage facilities had to be provided and a cost analysis was performed on several types of above-ground storage tank designs. The new water system at Port Deposit has been in operation since April, 1985; the plant is processing between 280,000 and 375,000 gpd. Consumption attributed to the town has varied between 150,000 and 175,000 gpd while supply to the Job Corps Center varies between 130,000 and 200,000 gpd. The plant is operated for eight to nine hours a day. Prechlorination is being carried out to a concentration of 10 ppm. Alum and soda ash feeds typically run about 30 ppm each. Generally, the raw water pH averages 7.3 to 7.5. (Khumbatta-PTT)
W87-02925

COST ANALYSIS OF THE ADVERSE EFFECTS OF ALGAL GROWTH IN WATER BODIES ON DRINKING WATER SUPPLY,
Institute of Public Health, Tokyo (Japan). Dept. of Sanitary Engineering.
Y. Magara, and S. Kunikane.
Ecological Modelling, ECMODT Vol. 31, No. 1-4, p 303-313, May 1986. 8 fig, 5 tab, 6 ref.

Descriptors: *Drinking water, *Adverse effects, *Water quality control, *Cost analysis, *Raw water, *Algae, Japan, Reservoirs, Water treatment, Concentration, Estimating, Estimated costs.

The effect of algae present in impounded raw water supplies on drinking water quality are reviewed, and estimates are provided of the additional costs of water treatment measures necessary to eliminate these adverse effects. Total treatment cost versus algal concentration in the raw water is presented (in Yen); treatment costs are significantly affected by the concentration of algae, both in conventional and advanced treatment processes. The treatment cost where the algal concentration is 10,000/ml is about twice that for the case of no algal effect. The present analysis did not account for several cost impact factors, including additional chlorine for prechlorination, energy consumption for transport of water between conventional and advanced water purification trains, additonal manpower, or capital costs of advanced treatment facilities. Thus, the present cost estimates are underestimates. (Rochester-PTT)
W87-02977

ANALYSIS AND CARTOGRAPHICAL APPROACH TO THE REGIONAL WATER UTILIZATION SYSTEM IN THE YODO RIVER BASIN,
Osaka Univ. (Japan). Dept. of Environmental Engineering.
For primary bibliographic entry see Field 6D.
W87-02978

CHEMISTRY OF TAP WATER IN SRI LANKA - IMPLICATIONS ON HEALTH,
Sri Lanka Univ., Peradeniya. Environmental Geochemistry Research Group.
C. B. Dissanayake, and S. V. R. Weerasooriya.
International Journal of Environmental Studies IJEVAW, Vol. 27, No. 1/2, p 57-69, 1986. 5 fig, 6 tab, 14 ref.

Descriptors: *Tap water, *Health hazards, *Water quality, *Sri Lanka, Hydrogen ion concentration, Lead, Piper trilinear diagram, Calcium, Magnesium, Bicarbonates, Ions.

A preliminary survey was conducted of the chemical quality of tap water in Sri Lanka. In certain parts of the country, excess quantitites of lead were found. The Piper trilinear diagram shows that much of the tap water of Sri Lanka belongs to the Ca/Mg-HCO3 type. In certain areas of the country tap water had low pH values, which could bring excess dissolved ions into the tap water. No serious health hazards due to poor quality tap water have been encountered in Sri Lanka because only a small percentage of the population has access to piped water. (Author's abstract)
W87-03026

WATER SUPPLY OF VARANASI - THE OLDEST CITY OF INDIA,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
M. Schalekamp.
Aqua AQUAAA, No. 4, p 173-176, 1986. 16 fig.

Descriptors: *Varanasi, *Water use, *Flocculation, *Filtration, *Settling basins, *Chlorination, India, Raw water, Ganges River, Cremation, Oxygen content, Bacteria.

The city of Varanasi (Benares, India), with a population of about 1 million, has already achieved the UNO Decade 1995 target for connection of its people to drinking water. The city provides each inhabitant with 240 l/day, which is more than 90 l above the acknowledged standard for India. The history of the city and its sources of water supply are described. The total consumption of the city is 240,000 cu m/day, of which 80,000 cu m is obtained from the River Ganges and the rest from wells. Three large settling basins are available for water treatment. Flocculation, filtration, and ultimately chlorination is used. Problems of raw water are created by the cremation of 500,000 persons on the banks of the Ganges, with the strewing of the ashes in the river. The river water oxygen content is from 20-60%, and there is not chemical pollution, but the bacteriological content of the water is enormous. (Rochester-PTT)
W87-03039

NEED FOR FLUORIDATION OF DESALINATED WATER SUPPLIES,
M. J. Hammer.
Aqua AQUAAA, No. 4, p 179-182, 1986. 3 fig, 1 tab, 12 ref.

Descriptors: *Fluoridation, *Diets, *Saudi Arabia, *Dental caries, *Children, *Desalination, Seawater, Groundwater, Public health.

The optimum fluoride concentration in drinking water during the formation of children's teeth reduces the incidence of dental caries and provides protection against decay for the lifetime of the people. Based on studies in similar climatic regions, the optimum fluoride ion concentration in Saudi Arabia is 0.7 mg/l. Public water supplies obtained from desalinating seawater and desalting groundwater are seriously deficient in fluoride, usually having less than 0.1 mg/l. The resulting deficiency in dietary fluoride will result in a tragic incidence of dental caries with an estimate of 6 decayed permanent teeth by age 12 yr and 12 by age 16 yr. Drinking optimally fluoridated water can reduce the rate by approximately 70%. It is recommended that the Kingdom of Saudi Arabia institute supplemental fluoridation of public water supplies as the foundation of a national program of dental caries prevention. (Author's abstract)
W87-03041

LESSONS FROM FIELD EXPERIENCE WITH RAINWATER COLLECTION SYSTEMS IN AFRICA AND ASIA,
B. Latham, and J. Gould.
Aqua AQUAAA, No. 4, p 183-189, 1986. 9 fig, 1 tab, 32 ref.

Descriptors: *Water tanks, *Rooftop collection systems, *Rainfall collectors, *Climate, Botswana, Kenya, Zimbabwe, Indonesia, Thailand, Ghala basket, Thai jumbo jar, Kenyan cement jar, Concrete ring tank, Poured concrete tank, Ferrocement tank, Bamboocement tank, Seasonal variation, Innovations.

Rainwater collection systems are described and evaluated based on field observations from projects observed in Botswana, Kenya, Zimbabwe, Indonesia, and Thailand. The Ghala basket, the Thai jumbo jar or Kenyan cement jar, concrete ring tank, poured concrete tank, ferrocement tank, and bamboocement tank are illustrated. The suitability of rainwater collection must be examined in terms of the potential for providing an acceptable full or partial service load. This depends on local rainfall, including the depth of rain and the length of the dry season, the maximum roof area available, and the degree to which the potential volume of water is used. Water quality, design considerations, use of local materials, and cost factors are discussed. The authors point out that many published descriptions of rainwater collection systems often overpraise new ideas without sufficient field experience. (Rochester-PTT)
W87-03042

WATER AND THE THIRD MILLENNIUM,
Indian Water Works Association, Bombay.
S. P. Unvala.
Aqua AQUAAA, No. 4, p 194-197, 1986.

Descriptors: *Water treatment, *History, *International Drinking Water Supply and Sanitation Decade Program, *Pollution, *International conflicts, *Human population, *Water supply, Pesticides, Fertilizers, Water demand, Water shortage, Water use, Industrial emissions.

The history of water treatment, the possibility of running out of water after the year 2000, factors to be faced by the International Drinking Water Supply and Sanitation Decade Program, the impact of pollution on world water, and the challenge of the future for water supply engineers are discussed. Population increases will likely lead to a 35% lesser per capita water availability worldwide due to this factor alone compared to today's total-use water availability. Other future difficulties anticipated include conflicts, including wars, over water supply from scarce resources and increased levels of pollution from pesticides, fertilizers, and industrial emissions. Despite these problems, the author is optimistic about the future accomplishments of the water works industry. (Rochester-PTT)
W87-03044

EFFECTS OF CORROSION CONTROL OF LOW ALKALINITY WATERS - NORWEGIAN EXPERIENCES,
E. A. Vik.
Aqua AQUAAA, No. 4, p 198-206, 1986. 14 fig, 3 tab, 19 ref.

Descriptors: *Low alkalinity water, *Norway, *Pipes, *Corrosion control, *Hydrogen ion concentration, Water treatment facilities.

In Norway, 86% of the population uses low alkalinity surface waters for potable water supply. To correct internal corrosion of pipes a guideline of pH 8.0-8.5 was set in the early seventies. The

existing corrosion control strategy has only involved an increase in the pH of treated water, with the following results: operational problems connected to pH regulation and signficantly different tap water compared to treated water. The present study of newer corrosion control strategies resulted in the following recommendations for treated water quality to protect pipes from internal corrosion: pH > 8.0, alkalinity > 0.65 millimole/l, and Ca > 18 mg/l. (Rochester-PTT)
W87-03045

FINANCIAL VIABILITY AND ECONOMIC EFFICIENCY OF WATER SUPPLY IN KWARA STATE - THE CASE OF ILORIN,
Ilorin Univ. (Nigeria). Dept. of Geography.
R. O. Oyegun.
Aqua AQUAAA, No. 4, p 207-213, 1986. 3 fig, 6 tab, 12 ref.

Descriptors: *Financing, *Water costs, *Water rates, *Nigeria, Kwara State, Ilorin, Cost analysis, Consumer classification, Water supply development.

The financial hindrance for water producing bodies in Nigeria can be removed if realistic prices are charged to consumers. For Ilorin, the capital of Kwara State, it is shown that the present water tariff is grossly unrealistic. Although metering of water for each consuming unit is impracticable, different rates can be charged according to use and population. The operational procedure for fixing a water tariff is suggested, based on consideration of different classifications of consumers, including individual families, institutions, industries, public and private standpipes, commercial establishments, and tankers. It is concluded that adequate water exists to meet the population's needs, but that water assessment forms to establish charges and a new department to conduct water use assessments and collect water rates are needed. (Rochester-PTT)
W87-03046

REVERSE OSMOSIS CAN BE COST EFFECTIVE,
For primary bibliographic entry see Field 3A.
W87-03079

DRINKING-WATER CONTRIBUTION TO NATURAL BACKGROUND RADIATION,
Environmental Protection Agency, Washington, DC. Office of Drinking Water.
C. R. Cothern, W. L. Lappenbusch, and J. Michel.
Health Physics HLTPAO, Vol. 50, No. 1, p 33-47, January 1986. 6 tab, 36 ref, append.

Descriptors: *Radon, *Radionuclides, *Drinking water, *Background radiation, *Dosimetry, Radiation exposure, Public health, International Commission on Radiological Protection, Biological Effects of Ionizing Radiation Committee, National Academy of Sciences, Environmental Protection Agency, Radon-222, Annual effective dose equivalent, Dosimetric models, Cohort analysis, Radioisotopes.

The average concentrations of naturally occurring radionuclides in drinking water are estimated from recent measurement and are used to estimate the annual effective dose equivalent associated with drinking water due to the different radionuclides. The annual effective dose equivalents are determined from the annual intake of these radionuclides using dosimetric information based on International Commission for Radiological Protection Publication 30 dosimetric models and cohort analysis considering risk coefficients developed by the Environmental Protection Agency using data from the report of the Biological Effects of Ionizing Radiation Committee (BEIR III) of the National Academy of Sciences. The resulting contribution from drinking water sources to the annual effective dose equivalent is in the range of 0.002 to 0.05 mSv/yr (0.2-5 millirem/yr) for those using community drinking water supplies (approximately 216 million people in the United States). The contribution to the annual effective dose equivalent for Rn-222 dissolved in water is in the range 0.8-30 microSv/yr (0.08-3 millirem/yr) based on the inhalation pathway following the release Rn-222 from drinking water. (Author's abstract)
W87-03084

EXPOSURE TO FLUORIDATED PUBLIC WATER SUPPLIES AND CHILD HEALTH AND BEHAVIOUR,
Christchurch Hospital (England). Christchurch Child Development Study.
For primary bibliographic entry see Field 5C.
W87-03092

PLANNING AND TECHNOLOGY IN SANITARY AND ENVIRONMENTAL ENGINEERING,
Johns Hopkins Univ., Baltimore, MD. Dept. of Sanitary Engineering and Water Resources.
For primary bibliographic entry see Field 6A.
W87-03098

HALOGENATED PHENOLS IN WATER AT FORTY CANADIAN POTABLE WATER TREATMENT FACILITIES,
Health and Welfare Canada, Ottawa (Ontario). Monitoring and Criteria Div.
B. B. Sithole, and D. T. Williams.
Journal Association of Official Analytical Chemists JANCA2, Vol. 69, No. 5, p 807-810, 1986. 4 tab, 34 ref.

Descriptors: *Canada, *Water treatment facilities, *Halogenated phenols, *Water analysis, *Phenol, Raw water, Seasonal distribution, Chemical dosages.

Samples of raw and treated water were collected once in each of 3 seasons at 40 potable water treatment plants across Canada and were analyzed for phenol and 33 halogenated phenolic compounds, including chlorophenols, bromophenols, bromochlorophenols, and chloroguaiacols. Eighteen of the compounds were not found at any treatment plant; phenol and each of the remaining halogenated phenols were found in at least 1 sample. Pentachlorophenol was the only halogenated phenolic compound found in more than 20% of the raw water samples in the fall and winter samples at levels of up to 53 nanogram (ng)/l, with mean values of 1.9 and 2.8 ng/l, respectively. No halogenated phenols were detected in raw water summer samples. The halogenated phenols found most frequently in treated water samples were 4-chloro-, 2,4-dichloro-, 2,4,6-trichloro-, and bromodichlorophenols. Mean values were less than 15 ng/l and maximum values seldom exceeded 100 ng/l. Most ot the positive values for the treated water samples were found at 8 of the 40 treatment plants, but no correlations could be found between halogenated phenol levels and raw water type, treatment process, or chemical dosages. (Author's abstract)
W87-03112

COUNTY'S SEARCH FOR LONG-TERM WATER SUPPLY PAYS OFF,
Ward (Frederick) and Associates, Inc., Bel Air, MD.
D. R. Hall.
Public Works PUWOAH, Vol. 117, No. 9, p 104-105, September 1986.

Descriptors: *Water supply systems, Design criteria, Water treatment facilities, Water treatment, Havre de Grace, Municipal water.

With a projected population increase from 78,000 to 108,000 by the year 2000, Harford County, Maryland officials realized in the late 1970s that they needed to provide the county with a long-term reliable water supply, which Harford's existing well fields could not supply. The County Department of Public Works had commissioned several studies to determine the most cost-effective source for a new water supply. Unfortunately, most of the recommended water sources were not politically or economically viable. However, there was one possible source that was acceptable to local officials. This source was the city of Havre de Grace. Situated at the mouth of the Susquehanna River, Havre de Grace has never lacked for water. The county approached the city and negotiated an agreement whereby Havre de Grace would provide the long-term water needs to the county. As part of the contract, the city agreed to expand the existing water filtration plant to provide the additional capacity. The county would pay for the expansion, but the plants and its operation would remain in city hands. The design would expand the plant capacity to the maximum possible without making expensive structural modifications to the existing structure. The plan was to modify the equipment used in the original design processes as much as possible, while optimizing existing space. A detailed hydraulic profile analysis through the existing plant indicated that the maximum hydraulic loading without major structural modifications was 4 mgd. Each treatment process was then evaluated as to its existing condition, capacity, and the feasibility of expansion to 4 mgd. Each treatment process was then evaluated as to its existing condition, capacity, and the feasibility of expansion to 4 mgd. Processes evaluated included: raw water pumping; flocculation; sedimentation; finish water pumping; chemical feeding, filtration and chlorination. Since the completion of the expanded plant, the County Department of Public Works has begun studying the second phase expansion of the Havre de Grace plant, which will use the same technology that was applied in the initial expansion and will be located adjacent to the existing plant. (Alexander-PTT)
W87-03119

DRINKING WATER MATERIALS: FIELD OBSERVATIONS AND METHODS OF INVESTIGATION,
Bonn Univ. (Germany, F.R.). Hygiene Inst.
D. Schoenen, and H. F. Scholer.
Ellis Horwood Limited, Chichester, England, 1985. Translated by B. D. Hemmings. 195 p.

Descriptors: *Water treatment, *Water distribution, *Water conveyance, *Water quality control, *Drinking water, *Water pollution sources, Metals, Cements, Mortar, Corrosion, Chemical precipitation, Organic compounds, Microbiological studies, Chemical analysis, Physical analysis, Toxicity.

During its passage from the point of abstraction to the consumer, drinking water comes into contact with a variety of materials such as metals, cement mortar or concrete, linings for pipes and reservoirs, and sealing materials. The water and the materials thereby undergo reciprocal changes. These interactions can be of an unremarkable nature, or they may lead to undesirable changes in the materials or in the water. The well-known types of defect such as materials degradation due to corrosion, precipitation or water constituents and formation of deposits and encrustations in pipelines are not considered here. Rather, concern is with the deterioration of water quality by organic materials or materials containing organic additives, and the most important change is the multiplication of microorganisms either in the water or on the surface of the materials. The literature cites a number of instances of bacteriological impairment of water quality due to materials, and accounts are given of some comparative experiments. So far, however, there has been no overall review of the large number of experimental procedures already devised. Field observations and laboratory investigations are dealt with in separate sections. This segregation was adopted in order to allow, on the one hand, a comprehensive review of the phenomena encountered in practice and, on the other, a similarly complete account of the various experimental procedures. The experimental methods are subdivided into: (a) microbiological; (b) chemical, physical, organoleptic; and (c) toxicological. (Lantz-PTT)
W87-03340

5G. Water Quality Control

ADSORPTION OF SELECT PHENOL DERIVATIVES BY DOLOMITE,
Argonne National Lab., IL. Chemical Technology

Div.
For primary bibliographic entry see Field 5B.
W87-02583

AMOCO CADIZ AND LIMITATION OF LIABILITY FOR OIL SPILL POLLUTION: DOMESTIC AND INTERNATIONAL SOLUTIONS,
For primary bibliographic entry see Field 6E.
W87-02593

TRIHALOMETHANE LEVELS IN CHLORINATED MICHIGAN DRINKING WATER,
Michigan State Univ., East Lansing. Inst. of Water Research.
For primary bibliographic entry see Field 5F.
W87-02605

EFFECTS OF WATER QUALITY PARAMETERS ON THE CORROSION OF GALVANIZED STEEL,
Environmental Science and Engineering, Inc., Gainesville, FL.
R. A. Pisigan, and J. E. Singley.
Journal of the American Water Works Association JAWWA5, Vol. 77, No. 11, p 76-82, November 1985. 11 fig, 4 tab, 26 ref. EPA Research Grant R805400010.

Descriptors: *Water quality control, *Gainesville, *Galvanized steel, *Water chemistry, *Corrosion, Florida, Corrosion control, Langelier index, Hydrogen ion concentration.

Jar tests and a circulating water system were used to evaluate the effect of water quality parameters, in particular the Langelier index (SI), on the corrosion of galvanized steel. Since waters with a positive SI were sometimes found to be at least as corrosive as waters with a negative SI, especially if the effect of dissolved oxygen was neglected, no definite relationship could be established between corrosion rate and SI. In Gainesville, Florida, in both tap water and deionized water, corrosion was observed to be fastest in the pH range 5-6.5. A general mechanism for the formation of corrosion products is presented. Overall results suggest that the SI should be used only with caution in the practice of corrosion control and that prediction of a water's corrosivity should also consider the influence of other water quality parameters. (Author's abstract)
W87-02608

MANAGING AN UNFILTERED WATER SUPPLY,
Seattle Dept. of Water, WA. Water Quality Div.
For primary bibliographic entry see Field 5F.
W87-02609

WATERBORNE VIRAL GASTROENTERITIS,
Health Effects Research Lab., Cincinnati, OH.
For primary bibliographic entry see Field 5C.
W87-02612

HYDROMETALLURGY: WINNING METALS WITH WATER,
Engineering-Science, Inc., Kuala Lumpar (Malaysia).
J.H. Canterford.
Chemical Engineering, Vol. 92, No. 22, p 41-48, October 28, 1985, 5 fig, 1 tab, 26 ref.

Descriptors: *Hydrometallurgy, *Solution mining, *Ores, *Water pollution prevention, Metallurgy, Effluents, Industrial water, Water use.

Extractive metallurgy may be divided into hydrometallurgy (HM) and pyrometallurgy (PM). Whereas in PM heat plays a major role, in HM, the solution in water (or solvents) is an essential feature. Three recently developed processes are outlined. Two, uranium- and zinc pressure-leaching are specific operations. The third, solution mining (SM), is a general concept. SM involves direct dissolution from an ore body. The leachant is pumped into the ore zone where it dissolves the appropriate minerals. The leachate is then pumped to the surface, the metal recovered and the leachate recycled. Disadvantages of SM include: scaleup factors are difficult to establish, prolonged operation periods are required, recovery is incomplete and groundwater outside the ore zone can be contaminated. Even though hydro operations for recovery of metals produced a range of liquid and solid effluents for proper disposal, HM plays a significant role in a wide range of effluent treatment procedures including: ion-exchange, solvent extraction, electrowinning and selective as well as bulk precipitation. These procedures ensure that HM effluents do not become environmental liabilities and generate income since they represent a method of resource conservation. (Alexander-PTT)
W87-02618

EFFICIENT METHOD OF APPLYING ALUMINUM SALTS FOR SEDIMENT PHOSPHORUS INACTIVATION IN LAKES,
New Hampshire Water Supply and Pollution Control Commission, Concord.
J. N. Connor, and G. N. Smith.
Water Resources Bulletin WARBAQ, Vol. 22, No. 4, p 661-664, August 1986. 1 fig, 1 tab, 5 ref.

Descriptors: *Water quality control, *Lakes, *Phosphorus removal, *Phosphorus, *Aluminum salts, *Lake sediments, Alum, Sodium aluminate, Cost analysis, Injection, Water treatment.

Alum and sodium aluminate were injected into the hypolimnion of eutrophic Kezar Lake, New Hampshire, with a specially designed applicator mechanism. This new method of applying aluminum salts to achieve phosphorus inactivation included two separate chemical distribution systems mounted on a hydraulic weed harvester. The design of the applicator system is described and its cost-effectiveness is compared with other aluminum salt injections. (Author's abstract)
W87-02635

ANTIDEGRADATION POLICY FOR PRESERVING SURFACE WATER QUALITY IN FLORIDA,
Florida State Dept. of Environmental Regulation, Tallahassee.
T. Swihart, O. E. Walton, and M. G. Pennington.
Water Resources Bulletin WARBAQ, Vol. 22, No. 4, p 665-671, August 1986. 1 fig, 4 tab, 16 ref.

Descriptors: *Florida, *Surface water, *Water quality control, *Water policy, Water quality standards, Environmental protection, Degradation, Environmental policy, Water management.

The State of Florida provides special protection for bodies of water of unusual importance that are designated Outstanding Florida Waters (OFW). New discharges are permitted only if stringent criteria are met. A new point source direct discharge into an OFW is usually not permitted if it would lower water quality and new indirect discharges are allowed only if they do not significantly degrade the OFW. The advantages of this system have clearly outweighed its disadvantages. OFW designations are helping to protect Florida's most valuable waters from additional degradation. This system could be a useful model for other jurisdictions wanting to provide special protection for special bodies of water. (Author's abstract)
W87-02636

COST OF PURE WATER,
B. Quinn.
The American City and County ACCOD3, Vol. 101, No. 6, p 52+, June 1986.

Descriptors: *Groundwater pollution, *Public opinion, *Water quality control, Water quality standards, Water treatment, Contamination, Carcinogens, Activated carbon, Airstripping, Drinking water.

Groundwater contamination problems are reviewed in terms of water quality standards and public perceptions of contamination problems and risks. Hazards from exposure to carcinogenic substances in drinking water are evaluated. Technological improvements in water treatement such as airstripping and granular activated carbon filtration are described. Several policy options for addressing public concerns regarding drinking water contamination are also explored. (Michael-PTT)
W87-02642

ROTAVIRUS SURVIVAL IN RAW AND TREATED WATERS AND ITS HEALTH IMPLICATIONS,
Ottawa Univ. (Ontario). Dept. of Microbiology and Immunology.
S. A. Sattar, R. A. Raphael, and V. S. Springthorpe.
Water Science and Technology WSTED4, Vol. 17, No. 10, p 7-14, October 1985. 5 fig, 1 tab, 27 ref. Ontario Ministry of Health Grant CHS-426.

Descriptors: *Rotaviruses, *Virus transmission, *Drinking water, *Water treatment, *Public health, *Survival, Human diseases, Diseases, Viruses, Enteroviruses, Potable water, Water quality management, Water pollution.

Rotaviruses cause acute gastroenteritis in man and animals. Although little is known about the mechanisms of transmission of these viruses in nature, fecally-contaminated water appears to play a role in this regard. This study was attempted to determine how well rotaviruses could survive in water, using calf rotavirus (strain C-486) grown in MA-104 cells. Samples of raw (RW) and municipally-treated tap water (TW) from the Ottawa River (Ontario) were contaminated with the virus to give a final concentration of approximately 50,000 plaque-forming units (PFU)/ml. The virus-contaminated water samples were held either at 4 C or 20 C in the dark for 64 days. In TW at 4 C, there was no significant drop in the virus titer even after 64 days, whereas at 20 C, the titer was reduced significantly over the same period. In RW, a significant drop in PFU occurred in 16 and 32 days at 20 C and 4 C, respectively. These data indicate that rotaviruses could survive long enough in the water environment to give water a considerable potential as a vehicle for their spread. (Author's abstract)
W87-02644

HIGH CONCENTRATION OF SOLUTES AT THE UPPER PART OF THE SATURATED ZONE (WATER TABLE) OF A DEEP AQUIFER UNDER SEWAGE-IRRIGATED LAND,
Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.
For primary bibliographic entry see Field 2F.
W87-02677

WAVE MOVEMENT AND WATER-QUALITY VARIATIONS DURING A CONTROLLED RELEASE FROM KIELDER RESERVOIR, NORTH TYNE RIVER, U. K.,
Loughborough Univ. of Technology (England). Dept. of Geography.
For primary bibliographic entry see Field 2E.
W87-02681

PRELIMINARY MODEL OF LONG-TERM CHANGES IN STREAM ACIDITY IN SOUTH-WESTERN SCOTLAND,
B. J. Cosby, P. G. Whitehead, and R. Neale.
Journal of Hydrology JHYDA7, Vol. 84, No 3/4, p 381-401, May 1986. 4 fig, 2 tab, 45 ref. NSF Grant CEE-8215914.

Descriptors: *Acidity, *Acid rain, *Dargall Lane, *Model studies, *Galloway, *Acid streams, Scotland, Deposition, Surface water, Water chemistry, Catchments, Hydrogen ion concentration, Salt, Mathematical models.

A modeling study was undertaken to investigate the long-term changes in stream acidity in Dargall Lane, a sub-catchment of Lock Dee, in Galloway, Scotland. The model is based on the assumption that surface water chemistry is determined by reactions taking place in the soils and rocks within a catchment. If sea salt deposition rates are main-

tained at 1984 levels, stream pH is likely to continue to decline below presently measured values. A 50% reduction in the deposition rate would result in an increase in the pH of the stream. (See also W87-02684) (Kane-PTT)
W87-02682

PROBLEM OF PHOSPHORUS IN FRANCE - ITS PRESENCE IN NATURAL WATERS AND BIOLOGICAL PHOSPHORUS REMOVAL,
Agence de Bassin Loire-Bretagne, Orleans (France).
J. C. Vinconneau, F. Schaack, A. F. Boschet, D. Chevalier, and D. Villesot.
Water Science and Technology WSTED4, Vol. 17, No. 11/12, p 1-9, 1985. 1 tab.

Descriptors: *Water pollution control, *Phosphorus, *France, *Phosphorus removal, *Eutrophication, *Water quality management, Nutrients, Nutrient removal, Water quality, Rivers, Public policy, Industrial wastes, Wastewater treatment.

The preferred method for the control of eutrophication is through the reduction of phosphorus inputs. The origin of these inputs and methods of limiting them are discussed, and it is concluded that elimination of eutrophication in rivers is possible, particularly through physicochemical and biological treatment processes in sewage treatment plants. However, much work is necessary to decide on a political framework for control policy and to assess new techniques of phosphorus removal and their field of application. It will also be necessary to limit agricultural discharges, which will require specific policies and information for farmers. Some work has already been done concerning the treatment of phosphorus in urban discharges, and a number of plants in France with activated sludge were equipped with physicochemical treatment in 1983. (Doria-PTT)
W87-02734

IN SITU AEROBIC BIODEGRADATION OF AQUIFER CONTAMINANTS AT KELLY AIR FORCE BASE,
Air Force Engineering and Services Center, Tyndall AFB, FL.
E. Heyse, S. C. James, and R. Wetzel.
Environmental Progress ENVPDI, Vol. 5, No. 3, p 207-211, August 1986. 2 fig, 2 tab, 8 ref.

Descriptors: *Aerobic treatment, *Groundwater pollution, *Biodegradation, *Aquifers, *Water quality management, *Water pollution treatment, *Kelly Air Force Base, *Biological treatment, Degradation, Waste disposal, Organic compounds, Geohydrology, Hydrocarbons, Aromatic hydrocarbons, Chlorinated hydrocarbons.

A waste disposal site at Kelly Air Force Base in Texas was chosen for a joint Air Force/EPA project to test in situ technology for treating a contaminated aquifer. The demonstration site is contaminated with a variety of organic wastes. The technology involves the use of indigenous subsurface bacteria to degrade some of the organic wastes. A process was designed to circulate groundwater using an extraction/infiltration well system. Oxygen is supplied to the subsurface by a hydrogen peroxide solution. No conclusions concerning the effectiveness of the treatment can yet be drawn. However, preliminary studies indicate that the site is amenable to biological reclamation, and that indigenous bacteria can be enhanced to degrade aliphatic and aromatic hydrocarbons and higher molecular weight halogenated aromatics. The limiting factor affecting site remediation is hydrogeology, specifically the highly stratified nature of the subsurface and the low hydraulic conductivities. These will interfere with the uniform dispersion of treatment chemicals and decrease their rate of transport through the aquifer. (Doria-PTT)
W87-02754

INDIANA WASTE DAYS BEYOND EXPECTATIONS,
K. F. Mouser.
Journal of Environmental Health JEVHAH, Vol. 49, No. 1, p 48, July-August 1986. 1 tab.

Descriptors: *Waste disposal, *Waste management, *Domestic wastes, *Drinking water, *Water pollution prevention, *Protection, Municipal wastes, Solid wastes, Public policy, Solid waste disposal.

Marion County, Indiana's Household, School, and Small Business Waste Collection days (September 27-28, 1985) received wastes from approximately 450 households and businesses. More than 6,000 containers of wastes were handled, including more than 500 containers of latex paints and 250 gallons of used motor oil. The purpose of the project was to protect ground and surface supplies of drinking water in Indianapolis. The collection effort proved that the community is receptive to such a project, and that individual households harbor a significant quantity of hazardous materials. (Doria-PTT)
W87-02757

LOW LEVEL RADIOACTIVE WASTE DISPOSAL--TECHNOLOGY AND PUBLIC POLICY,
For primary bibliographic entry see Field 5E.
W87-02775

WATER SUPPLY IN DEVELOPING COUNTRIES: IMPROVING ON CURRENT PRACTICE,
A. D. Barrett, and M. B. Pescod.
Journal of the New England Water Works Association JNEWA6, Vol. 100, No. 2, p 195-232, June 1986. 4 fig, 4 tab, 24 ref.

Descriptors: *Developing countries, *Water supply, *Water resources development, *Project planning, Water supply development, Training, Design criteria, Design standards, Standards, Drinking water, Water quality management, Water quality standards, Technology, Technology transfer, Water distribution, Economic aspects, Decision making, Engineering.

The needs of developing countries for urban and rural water supply will be met only if adequate funds are made available during the United Nations International Drinking Water Supply and Sanitation Decade and if improvements are made in current practice. Critical areas of specialist activity are considered based on the authors' own experience, as well as a review of the literature. Areas covered include design criteria and standards, available technology, source selection and development, water treatment and distribution, technology transfer, education, on-the-job training, research and development, the role of international agencies, master plans and feasibility studies, cost considerations, engineering studies, and implementation. (Doria-PTT)
W87-02784

MARYLAND'S PHOSPHATE BAN-HISTORY AND EARLY RESULTS,
Washington Suburban Sanitary Commission, Hyattsville, MD.
E. R. Jones, and S. D. Hubbard.
Journal - Water Pollution Control Federation JWPFA5, Vol. 58, No. 8, p 816-822, August 1986. 3 fig, 1 tab, 5 ref.

Descriptors: *Water quality control, *Water pollution prevention, *Phosphates, *Maryland, Chesapeake Bay, Wastewater treatment, Detergents.

Maryland's phosphate ban was successfully implemented on December 1, 1985. Some preliminary conclusions can be drawn. The first signs of phosphorus reduction occurred in October 1985 because detergent manufacturers anticipated the restrictions. Influent phosphorus concentrations decreased 32%, typically from 7.3 to 5.0 mg/liter. Background phosphorus removal mechanisms seemed to be unaffected by the influent phosphorus decrease. Chemical addition rates required to meet permit limits were cut back 50-60% because the influent concentrations had declined. Sludge production also dropped with the decrease in required chemicals. Cost savings are expected, but further data is needed to confirm the amounts. (Cassar-PTT)
W87-02819

DEVELOPING MANAGEMENT GUIDELINES FOR RIVER NITROGENOUS OXYGEN DEMAND,
Ministry of Works and Development, Hamilton (New Zealand). Water Quality Centre.
A. B. Cooper.
Water Pollution Control Federation Journal JWPFA, Vol. 58, No. 8, p 845-852, August 1986. 11 fig, 3 tab, 27 ref.

Descriptors: *Path of pollutants, *Water pollution control, *Water quality control, *Nutrients, *Oxygen demand, *Nitrogen, *Nitrification, Rivers, Dissolved oxygen, Model studies, Plankton.

Techniques exist for modeling the course of planktonic nitrification in rivers and its likely impact on dissolved oxygen. The generalized Monod model which incorporates both variable nitrifier biomass and variable substrate concentration should be used because more simple alternative models are inappropriate for most situations. Planktonic nitrification may be a significant cause of dissolved oxygen depletion only when the reaeration coefficient (base e) is less than 4 per day, ammonium concentration is greater than 1.5 g/cu m N, and travel times exceed approximately 9 days. Benthic nitrification can be modeled for existing discharges, provided a corroboration survey is carried out at an initial ammonium load which is markedly different from the load in the calibration survey. Reported values for the first-order nitrification decay coefficient and the zero-order nitrification decay rate for rivers demonstrate large variation. This precludes any generalizations on the importance of benthic nitrification. Research on the application of reaction-diffusion models to the sediment-water interface of rivers should reveal the fundamental processes that control benthic nitrification. This should lead to generalized concepts that are useful to water managers who attempt to make predictions for entirely new situations. (Cassar-PTT)
W87-02822

APPLICATION OF ENVIRONMENTAL MANAGEMENT PRINCIPLES IN THE PROGRAM FOR ERADICATION OF AEDES (STEGOMYIA) AEGYPTI (LINNEUS, 1762) IN THE REPUBLIC OF CUBA, 1984,
Ministry of Public Health, Havanna (Cuba). National Aedes aegypti Eradication Campaign.
J. A. Armada Gessa, and R. Figueredo Gonzalez.
Pan American Health Organization Bulletin, Vol. 20, No. 2, p 186-193, 1986. 2 tab, 13 ref.

Descriptors: *Insect control, *Mosquitoes, *Human diseases, *Epidemics, *Dengue, *Education, Malathion, Temephos, Fenthion, Perifocal treatment, Larvivorous fish, Habitats.

The dengue epidemic that struck Cuba in 1981 caused 344,203 reported cases and 158 deaths. The Cuban government's response was to launch an eradication campaign against the vector mosquito (Aedes aegypti) by spraying (with malathion, using ultra-low volume methods) to kill adults in the first few months and by adoption of various longer-term measures designed to progressively reduce and eliminate mosquito populations. These latter measures included focal and perifocal treatment of breeding areas (with temephos and fenthion), physical destruction of actual or potential breeding areas, modification of drinking-water tanks and other containers to render them unsuitable for aegypti proliferation, stocking of lakes and ponds with larvivorous fish, an intensive health education campaign, pursuit of ongoing aegypti surveillance activities, and enforcement of sanitary regulations prohibiting the maintenance of conditions suitable for aegypti breeding. This effort reduced the aegypti house infestation index from 11% or more in early August 1981 to 0.1% in January 1982, and has succeeded in keeping it down to around that level or below through April 1984. (Rochester-PTT)
W87-02824

MANAGING THE INDUSTRIAL/HAZARDOUS CONTRIBUTIONS TO THE NIAGARA RIVER,
New York State Dept. of Environmental Conservation, Albany.
J. J. Spagnoli.
Northeastern Environmental Science, Vol. 5, No. 1/2, p 23-32, 1986. 5 tab, 7 ref.

Descriptors: *Water pollution control, *Water quality control, *Fate of pollutants, *Water pollution sources, Industrial wastes, Chemical wastes, Rivers, Niagara River, New York, Water policy, Public participation, Landfills.

The Niagara River (New York State) with a flow of 200,000 cu/ft/sec remains environmentally threatened. Past industrial growth has left the drainage basin rich in uncontrolled hazardous waste dumps, contaminated plant sites and manufacturing facilities which generate volumes of toxic waste. These loadings have resulted in large areas of contaminated sediments and significant levels in fish flesh. New York State Department of Environmental Conservation had reacted to this problem by: (1) sponsoring a major binational study designed to evaluate the conditions and recommend remedial measures, (2) implementing more restrictive user permits with enhanced oversight monitoring, (3) taking immediate action to start remedial programs at the major waste sites. The success of such programs is slow in coming. Once the issue is made public, the public demands immediate action especially where problem sites are in their community. Considering the low level at which some contaminants are dangerous, and the complexities inherent in landfills, quick solutions are rarely available. The program has the prospect of success given sufficient time and will be the action that returns the river to environmental health. (Author's abstract)
W87-02828

TOXIC SUBSTANCES, RISK MANAGEMENT AND NEW YORK STATE DRINKING WATER,
New York State Dept. of Health, Albany.
For primary bibliographic entry see Field 5B.
W87-02832

ASSESSMENT OF THE IMPACT OF EUTROPHICATION CONTROL MEASURES ON SOUTH AFRICAN IMPOUNDMENTS,
Orange Free State Univ., Bloemfontein (South Africa). Inst. of Environmental Sciences.
D. C. Grobler.
Ecological Modelling, ECMODT Vol. 31, No. 1-4, p 237-247, May 1986. 7 fig, 24 ref.

Descriptors: *Reservoirs, *South Africa, *Eutrophication, *Water quality control, *Mathematical models, *Phosphate budget, Hydrologic budget, Hartbeespoort Dam, Bloemhof Dam, Prediction.

Because the standard OECD eutrophication modeling approach, which assumes catchment-reservoir systems to be in steady state, has limited values for decision-making under the large seasonal and annual variations in runoff, phosphate loads, and water levels in South African reservoirs, a simple but dynamic reservoir eutrophication model was developed for predicting the trophic response of reservoirs. The model consists of a hydrologic model, point and non-point source phosphate export models, a water budget model and a dynamic phosphate budget model as sub-models. The application and usefulness of the reservoir euthrophication model as a decision-making aid were demonstrated by predicting the consequenses of applying a 1 mg/l P standard in the drainage basins of Hartbeespoort and Bloemhof Dams, South Africa. (Rochester-PTT)
W87-02973

BASIN-WIDE ECOLOGICAL FATE MODEL FOR MANAGEMENT OF CHEMICALS HAZARD,
Osaka Univ. (Japan). Dept. of Environmental Engineering.
For primary bibliographic entry see Field 5B.
W87-02975

EFFECT OF METAL CHELATION ON THE TOXICITY OF SOME ENVIRONMENTALLY HAZARDOUS TRACE METALS TO DAPHNIA MAGNA,
Ecole Nationale Travaux Publics en l'Etat, Vaulx-en-Velin (France).
S. V. R. Rao.
International Journal of Environmental Studies IJEVAW, Vol. 26, No. 1/2, p 87-90, 1985. 2 tab, 6 ref.

Descriptors: *Daphnia, *Arsenic, *Toxicity, *Trace metals, *Water pollution effects, *Water pollution treatment, *Bioassay, *Chelation, Ethylene diamine tetraacetic acid, Manganese, Lead, Cadmium, Mercury, Chromium, Copper, Mortality, Humic acid, D-penicillamine, Crustaceans, Detoxification.

Metal sequestration with ethylene diamine tetraacetic acid (EDTA) nullified the toxicity of the potentially hazardous trace metal ions Mn(2+), Pb(2+), Cd(2+), Hg(2+), Cr(6+), and Cu(2+) to Daphnia magnia. Metal chelation in the cases of Mn(2+), Pb(2+), Cd(2+), and Hg(2+) remarkably increased the concentration of trace ions required to cause 50% mortality. It is suggested that other naturally occurring and commercially available chelating agents, such as humic acid and d-penicillamine, could be used effectively as chelating agents for the detoxicification and sequestering of persistent trace metal ions like As(3+). EDTA, even at high concentrations, had no effect on As(3+) toxicity in the present study, which indicates that EDTA had failed to sequester the ion. (Rochester-PTT)
W87-03024

FERTILIZERS SUITABLE FOR THE ENVIRONMENT AS PART OF A REORIENTATION IN AGRICULTURAL POLICY,
Federal Association of the German Gas and Water Industry, Bonn (Germany, F.R.).
W. Pluge.
Aqua AQUAAA, No. 4, p 177-178, 1986.

Descriptors: *Nitrate, *West Germany, *Water pollution control, *Fertilizers, *Groundwater pollution, *Cost allocation, European Community, Polluter-pays principle, Compensation, Water penny.

The level of nitrate in some ground and surface water sources is increasing in the Federal Republic of Germany, although there are regional variations. This results from incorrect use of nitrate fertilizers. The representatives of agricultural interests want the water supply companies (and thus consumers) to pay compensation ('water penny') to farmers for reducing or eliminating the use of nitrate fertilizers. This demand contradicts the polluter-pays principle and is, moreover, to be rejected for legal and fiscal reasons. The water industry cannot be expected to bear burdens that are the result of the European Community's common agricultural policy. (Author's abstract)
W87-03040

PETROLEUM RECOVERY OPERATIONS IN AN URBAN AREA,
New York State Dept. of Transportation, Hauppauge.
D. J. Kost, and W. Parish.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 4, p 542-550, October 1986. 4 fig, 1 tab, 5 ref.

Descriptors: *Cleanup operations, *Oil recovery, *Urban areas, *Nassau County, *Suffolk County, *Water pollution prevention, Groundwater pollution, Discharges, Site well installations, Water pollution treatment, Aquifers, Groundwater, New York, Oil pollution.

The storage and handling of large amounts of petroleum products in a 'sole source aquifer' area, such as both Nassau and Suffolk Counties of Long Island, NY, which have had numerous groundwater contamination problems. Recent legislative actions have provided a method for minimizing future discharges but many previous and on-going discharges of petroleum remain to be cleaned up. Recovery operations utilizing: (1) positive and negative ventilating systems; (2) site well installation; (3) recovery well depression systems; and (4) treatment of discharge waters, have developed into effective and efficient cleanup techniques. The prevention of discharges of petroleum into aquifers, also requires action, such as : (1) the replacement of steel tanks with cathodically protected steel, glass fiber reinforced plastic, steel clad with glass fiber reinforced plastic, double-walled steel, etc.; (2) corrosion protection for piping; (3) inventory control; (4) leak detectors; and (5) testing programs. Vigorous programs concerning petroleum storage are needed immediately by federal, state, and local government as well as by private industry. (Author's abstract)
W87-03065

HALOGENATED PHENOLS IN WATER AT FORTY CANADIAN POTABLE WATER TREATMENT FACILITIES,
Health and Welfare Canada, Ottawa (Ontario). Monitoring and Criteria Div.
For primary bibliographic entry see Field 5F.
W87-03112

SAFE DRINKING WATER ACT,
Camp, Dresser and McKee, Inc., Boston, MA.
For primary bibliographic entry see Field 6E.
W87-03122

CONSTRUCTING A BETTER ENVIRONMENT,
S. J. Hope.
Civil Engineering, Vol. 56, No. 10, p 66-68, October 1986.

Descriptors: *Construction, *Waste disposal, Waste management, Contracts, Water pollution control. Water pollution prevention.

Problems associated with construction stage pollution control and waste disposal were described. The responsibility of a prime contractor for a subcontractor's waste handling, treatment and disposal practices was discussed. (Michael-PTT)
W87-03126

SELECTIVE WITHDRAWAL: BASIC CONCEPTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8B.
W87-03222

HYDRAULIC DESIGN OF THE SELECTIVE WITHDRAWAL STRUCTURES OF THE LOST CREEK DAM,
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 8A.
W87-03223

HYDRAULIC DESIGN OF THE SELECTIVE WITHDRAWAL STRUCTURES OF THE APPLEGATE DAM,
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 8A.
W87-03224

RESERVOIR REGULATION AND SELECTIVE WITHDRAWAL IN OREGON,
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 6D.
W87-03226

OPERATION OF SELECTIVE WITHDRAWAL FACILITIES: LIBBY DAM, MONTANA,
Corps of Engineers, Seattle, WA. Seattle District.
For primary bibliographic entry see Field 5C.
W87-03227

ALTERNATIVES FOR IMPROVING RESERVOIR WATER QUALITY,

Army Engineer District, Little Rock, AR.
M. Morehead.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 42-47, 3 tab.

Descriptors: *Water quality control, *Reservoir operation, *Selective withdrawal, Table Rock Lake, Missouri, Dissolved oxygen, Water quality, Flow rates, Reservoir design, Dams, Nonstructural alternatives, Water use, Temperature.

Seasonal stratification in Table Rock Lake results in hydroelectric power generation releases which do not meet Missouri's State Water Quality Standard of 6 mg/L DO (dissolved oxygen) for downstream Lake Taneycomo. The Little Rock District studied the problem in response to a request by the State of Missouri. A successful solution of the problem is complicated by the magnitude of the flow rates of the turbine discharge. The 16,000 cfs upper design limit is equivalent to nearly 7.2 million gallons per minute. This is far in excess of the capacity of commercially available industrial equipment for mixing or adding oxygen for water treatment. Twenty-five alternatives were evaluated for technical, environmental, economic, and social acceptability. Of these, only two plans, which utilize selective withdrawal structures, have the potential to meet the Missouri water quality standards of 6 mg/L DO. The nonstructural alternative which has been used on an interim basis was among the plans considered. The nonstructural plan involves a restricted operation which results in a substantial improvement in the quality of power generating releases, but it does not meet the State Water Quality Standard. The use of selective withdrawal structures on two of the four penstock intakes has been identified as the most economically efficient solution. The application of selective withdrawal structures at Table Rock Dam is complicated by the need to meet both temperature and dissolved oxygen standards. Mathematical and physical model studies are needed to verify whether the structures can accomplish the objective and to develop additional engineering details for the selective withdrawal structures for Table Rock Dam. (See also W87-03221) (Author's abstract)
W87-03228

REVIEW OF SELECTIVE WITHDRAWAL PERFORMANCE IN THE FORT WORTH DISTRICT,
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 6B.
W87-03229

MODELING OF SELECTIVE WITHDRAWAL INTAKE STRUCTURES,
Army Engineer District, Fort Worth, TX.
C. Alloju.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 53-58, 2 tab, 2 ref.

Descriptors: *Selective withdrawal, *Model studies, *Intake gates, *Water quality control, Georgetown Lake, Granger Lake, Texas, Simulation analysis, Cooper Lake, Thermal water, Dam design, Floodgates.

The Fort Worth District Corps of Engineers has several projects which can withdraw lake water from different selected levels. Two of those projects are Georgetown Lake and Granger Lake which were built recently. The two other projects, Joe Pool and Ray Robert Lakes with selective withdrawal capability are under construction. A thermal simulation study has just been completed for the proposed Cooper Lake Project to determine if a selective withdrawal structure is needed. Although selective withdrawal outlet structures that have been built recently are designed primarily for downstream temperature control, they are seldom used for this purpose. The reason is that all these projects are operated primarily for flood control and water supply. Flood control releases are made either through the flood conduit or spillway gates. Water supply releases, instead of being released through low flow multilevel outlets, are pumped out directly into treatment plants. With this method of operation, these projects are still able to support some very good quality fishlife below them. Maintenance of downstream temperature control is not critical at any of the projects. The multilevel withdrawal capability is there just in case of a need for mixing upper level water with lower level water to achieve desired release temperatures. In general, policy has been to release water from the highest port for water quality benefit. (See also W87-03221) (Author's abstract)
W87-03230

BLOOMINGTON DAM, POTOMAC RIVER WATER QUALITY OUTLET,
Corps of Engineers, Omaha, NE.
F. Vovk, and L. S. Horihan.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 59-64, 3 fig, 2 tab.

Descriptors: *Water quality control, *Bloomington Dam, *Potomac River, *Water quality, *Selective withdrawal, Reservoir management, Wells, Values, Dam design.

The criteria available and the development of rationale for the design of the multilevel outlet facility for selective withdrawal to achieve the desired water quality conditions for use downstream from Bloomington Dam are discussed. The justification for selection of the water quality system features are presented, and recommendations for future projects are furnished. Based on the experience gained during a short period of operation, changes suggested are (a) use of an 8-foot diameter inlet and wet well system; (b) increase the size of the air vents; (c) investigate replacement of butterfly valves; and (d) isolate the common bulkhead opening. (See also W87-03221) (Lantz-PTT)
W87-03231

WATER QUALITY OUTLET WARM SPRINGS DAM,
Corps of Engineers, Omaha, NE.
F. Vovk, and L. S. Horihan.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 65-70, 2 fig, 2 tab.

Descriptors: *Water quality control, *Warm Springs Dam, *Outlets, California, Temperature, Turbidity, Water pollution effects, Valves, Inlets, Dam design.

The analysis and design of the outlet works for Warm Springs Dam on Dry Creek in Sonoma County, California, are discussed. Water quality design considerations include both temperature and turbidity of the discharged water which could pose problems to fish and wildlife downstream from the dam. A selective withdrawal system that would discharge the water at several selected elevations was considered to be needed to improve the downstream water quality. The adopted method of improving the quality of released water and final recommendations are presented. As more experience is gained with selective withdrawal systems, changes and improvements in the water quality outlet will be incorporated. These changes could include (a) Larger air vents for wet wells; (b) Improved gate valves for inlet pipe control; (c) Larger inlet and wet well pipes; (d) A transition section between the inlet and wet well; and (e) Provisions for blocking the low flow bulkhead slots between inlet pipes. (See also W87-03221) (Lantz-PTT)
W87-03232

HYDRAULIC DESIGN: BLOOMINGTON LAKE AND F. E. WALTER DAM PROJECT'S SELECTIVE WITHDRAWAL STRUCTURES,
Corps of Engineers, Baltimore, MD. Baltimore District.
For primary bibliographic entry see Field 8A.
W87-03233

DETERMINATION OF SELECTIVE WITHDRAWAL SYSTEM CAPACITY FOR INTAKE TOWER DESIGN,
Corps of Engineers, Baltimore, MD. Baltimore District.
K. S. Lee.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 77-86, 1 fig, 5 tab.

Descriptors: *Selective withdrawal, *Intake towers, *Dam design, *Water quality control, Flood flow, Reservoirs, Dam operation, Temperature, Flow profile, Environmental effects.

A method for determining selective withdrawal system (SWS) capacity was recently developed. This method evaluates the expected impacts on water quality when the SWS ability to control release quality is exceeded. This can occur under normal flow operations as well as flood flow operations. The capacities needed to avoid disastrous consequences are evaluated by this method. The procedure for determining capacity is to analyze and to prioritize the water quality control objectives at the project. This includes an evaluation of the effects of the project on water quality in the reservoir and downstream under all anticipated or likely configurations of operation. A case study is used to illustrate the procedure step by step. The example considers downstream water temperature control as the primary concern. Downstream temperature objectives, monthly flow distribution and maximum reasonable discharge during flood flow and normal flows are analyzed. Water temperature profiles from a thermal model are used to estimate downstream temperature deviation extremes under various flow control operations using several system capacities. The results are compared to temperature deviations which could be expected to cause fish kills. The final selection of the system capacities is based on the capacity which can avoid this critical deviation. (See also W87-03221) (Author's abstract)
W87-03234

SELECT: THE NUMERICAL MODEL,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
S. C. Wilhelms.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 87-92, 3 fig, 7 ref.

Descriptors: *SELECT, *Mathematical models, *Computer programs, *Selective withdrawal, *Water quality control, Stratification, Impoundments, Mathematical studies, Model studies, Temperature, Dissolved oxygen, Conductivity, Suspended solids.

Significant research has been conducted on the characteristics of withdrawal from a stratified impoundment. The results of this work within the Corps of Engineers is the numerical model SELECT. SELECT is a computer program that models one-dimensionally the withdrawal zone formed by release from a stratified reservoir through an outlet device. The program also computes the quality characteristics of the release for user-specified parameters such as temperature, dissolved oxygen (DO), conductivity, and dissolved or suspended solids. This paper is devoted to describing SELECT, its subroutines, capabilities, and limitations. (See also W87-03221) (Lantz-PTT)
W87-03235

BLENDING IN A SINGLE WET WELL,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
S. Howington.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 93-98, 3 fig.

Descriptors: *Blending, *Mixing, *Inlet wells, Stratification, Homogeneity, Hydraulic properties,

Flow velocity, Lost Creek Dam, Oregon, Hydroelectrical plants, Model studies, Selective withdrawal, Flow profiles.

The concept and application of blending various qualities of water in a single wet well is discussed. The theory presented makes several simplifying assumptions which prevent its direct application to physical situations. These assumptions include: (a) the stratification consists of two, separate, homogeneous layers of water, (b) the water entering the lower port does not cause mixing as it deflects off the back wall of the tower, (c) the energy losses other than entrance losses are negligible, (d) the lower port velocity jet does not cause hydraulic blockage of the wet well. The Lost Creek Dam in southern Oregon has a single wet well intake structure with a total of 12 ports at 5 levels over a vertical distance of 280 ft. It also has hydropower at the downstream end. Blending in this single wet well has been occurring for at least 6 years and the outflow data confirm that blending is occurring. Blending has also been observed in two generic models and in a scale model of the Lost Creek structure. In these models, the critical discharge occurred at a much lower discharge than theory predicted. The mixing due to the velocity jet impinging on the back wall was plainly visible. Hydraulic blockage has not been observed in any of these models. An accurate description of the impacts of density stratification on multi-level, single wet well withdrawal will require much more investigation into the mixing characteristics in the wet well and the effects of density on flow distribution between port elevations. (See also W87-03221) (Lantz-PTT)
W87-03236

DESIGN OF SELECTIVE WITHDRAWAL INTAKE STRUCTURES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8A.
W87-03237

OPERATIONAL TOOLS: SELECTIVE WITHDRAWAL AND DAILY OPERATIONAL STRATEGY,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
J. P. Holland, and S. C. Wilhelms.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 105-109, 2 fig, 4 ref.

Descriptors: *Selective withdrawal, *Reservoir operation, *Mathematical analysis, *Water quality control, Stratification, Reservoirs, Mathematical models, SELECT, Computer programs, Long-term planning, Model studies.

The authors present the results of recent selective withdrawal research in the form of a general mathematical description of this stratified flow phenomenon. Results of past and present researchers were compared. Through symmetry arguments and the withdrawal angle concept, those results were reduced to a single expression. A new description for boundary interference, which often impacts the formation of the withdrawal zone, was explicitly included in the mathematical formulations. These results were incorporated into the computer code SELECT, a numerical model of withdrawal from a stratified impoundment. This model has been used extensively for long-term evaluation purposes in conjunction with reservoir simulation models. However, when coupled with a port-selection algorithm, the model has excellent potential as a tool for day-to-day decisions regarding hydraulic structure operation. The authors present an example of model application to provide guidance on outlet structure operation for maintenance of release water quality. (See also W87-03221) (Author's abstract)
W87-03238

OPERATIONAL TOOLS: OPTIMAL CONTROL OF RESERVOIR WATER QUALITY,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
S. C. Wilhelms, and M. L. Schneider.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 110-115, 3 fig, 4 ref.

Descriptors: *Water quality control, *Selective withdrawal, *Reservoir operation, Simulation analysis, Model studies, Thermal stratification, Thermal effects, Stratification, Computer programs.

A one-dimensional reservoir thermal simulation model developed by the U.S. Army Engineer Waterways Experiment Station, was used to simulate the thermal stratification cycle of a reservoir. The model was interfaced with a formulation called objective-space dynamic programming (OSDP) to develop the optimal operation strategy for each decision period. The OSDP formulation retains the integrity of the simulation model and minimizes the deviations of predicted release temperature from downstream target temperature over the stratification cycle. Application to a case study shows the potential for using the dynamic programming technique, as compared to the normal period-by-period operation, to improve performance of the system. (See also W87-03221) (Lantz-PTT)
W87-03239

THOUGHTS AND CONSIDERATIONS FOR HYDRAULIC DESIGN,
For primary bibliographic entry see Field 8B.
W87-03241

SELECTIVE WITHDRAWAL NEEDS FOR LAKE GREESON ARKANSAS INTAKE STRUCTURE,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
R. E. Price, and D. R. Johnson.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 140-146, 5 fig, 5 ref.

Descriptors: *Selective withdrawal, *Lake Greeson, *Arkansas, *Water quality control, Little Missouri River, Dams, Reservoirs, Limnology, Dissolved oxygen, Temperature, Seasonal variations.

Lake Greeson, a 7,000 acre reservoir located on the Little Missouri River in west central Arkansas, is an authorized combined power and flood control project. The 941-ft-long concrete dam, which was completed in 1953, provides up to 407,900 acre-feet of storage with 128,200 acre-feet allocated for flood protection, and 202,100 acre-feet for power generation. Normal releases from the three penstocks, each 8.5 feet in diameter, are from elevation 485 NGVD with flood control gates located at 444 NGVD. Lake Greeson may be classified as a monomictic lake with typical thermal stratification and low dissolved oxygen levels in the hypolimnion. Because the penstocks are located in the hypolimnial region, discharges during the summer months are much cooler than inflows and much lower in dissolved oxygen and release flows are not stable enough to sustain a cold water fishery. This creates stress on the downstream environment and fishery, which the Arkansas Game and Fish would like for the Corps to improve. For a 3 year period between 1981 and 1984, temperature and dissolved oxygen monitors were placed on the inflow and discharge of Lake Greeson to identify the extent of the problems. Results of this investigation indicate that the temperatures of the releases are much colder than inflows during the late spring and summer, and that dissolved oxygen levels may drop below state standards for extended periods of time. To correct this problem, several alternatives are available and range from multilevel outlets to simply plating over the trash racks. Evaluation of these alternatives is underway. (See also W87-03221) (Author's abstract)
W87-03242

SELECTIVE WITHDRAWAL STRUCTURE OPERATION EXPERIENCES IN ORD,
Army Engineer Div. Ohio River, Cincinnati.
For primary bibliographic entry see Field 8A.
W87-03243

OVERVIEW OF PITTSBURGH DISTRICT SELECTIVE WITHDRAWAL OPERATION EXPERIENCES,
Army Engineer District, Pittsburgh, PA.
M. Koryak.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 152-157, 8 fig.

Descriptors: *Selective withdrawal, *Water quality control, *Pittsburgh, *Pennsylvania, Dams, Reservoir operation, Intakes, Temperature, Reservoirs, Stratification, Hydroelectric plants, Iron, Manganese, Aluminum, Hydrogen sulfide, Ammonia.

The Pittsburgh Engineer District is currently operating four structures with selective withdrawal intakes. One of the most important lessons that the District has learned in its more than three decades of experience with these structures is that operating objectives can change and operational flexibility is highly desirable. The District has utilized selective withdrawal to maintain both cold and warm water outflow fisheries and other outflow temperature objectives; for the conservation of warm, cold, and very cold water strata within a reservoir to maintain a 'three story' lake fishery; to control outflow water quality; for the control of reservoir stratification patterns to promote in-pool mixing and dilution of acid mine drainage pollution; and to control reservoir primary biological productivity. Other existing and potential problems involve pump-back currents and stratification disruption from pumped-storage hydropower generation, conventional hydropower conversion of existing projects, and periodic summer flood event drawdowns where the required discharge exceeds the capacity of the selective withdrawal system. During such events, cold hypolimnetic waters with high Fe, Mn, Al, H2S and NH3 concentrations have been discharged through sluice gates. Similar problems have occurred during maintenance shutdowns of systems and there have been a few learning curve misunderstandings and mistakes. (See also W87-03221) (Lantz-PTT)
W87-03244

SELECTIVE WITHDRAWAL FROM ANY LEVEL BETWEEN MINIMUM POOL AND SPILLWAY ELEVATION AT STONEWALL JACKSON DAM, WEST VIRGINIA,
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 8A.
W87-03245

SELECTIVE EXPERIENCES: ALIAS WITHDRAWAL PAINS,
Corps of Engineers, Huntington, WV. Huntington District.
For primary bibliographic entry see Field 6B.
W87-03246

DESIGN AND PERFORMANCE OF SKIMMING WEIRS IN THE KANSAS CITY DISTRICT,
Corps of Engineers, Kansas City, MO. Kansas City District.
For primary bibliographic entry see Field 8A.
W87-03247

MANAGEMENT OF BOTTOM SEDIMENTS CONTAINING TOXIC SUBSTANCES.
Army Engineer Inst. for Water Resources, Fort Belvoir, VA.
Available from the National Technical Information Service, Springfield, VA. 22161. Proceedings of the 10th U.S./Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. 414 p.

Descriptors: *Sediment contamination, *Water pollution control, *Bottom sediments, *Toxins, *Water quality control, *Marine environment,

Legal aspects, Research priorities, Organic compounds, Dredging.

This meeting is held annually through an agreement with the U.S. Army Corps of Engineers and the Japan Ministry of Transport to provide a forum for presentation of papers and in-depth discussions on dredging and disposal of contaminated sediment. Experts from both countries presented technical papers on a variety of subjects including legal and research programs to evaluate and protect the marine environment. More specifically, subjects included evaluating and predicting and behavior of nutrients, organics, and contaminants in dredged sediments and identifying and evaluating the many alternatives to dredging and disposing of contaminated sediments and waters associated with these sediments. Management practices with the most promising long-term utility were emphasized. (See also W87-03249 - W87-03271) (Lantz-PTT)
W87-03248

LEGAL SYSTEM AND WORKS FOR PRESERVATION OF THE PORT, HARBOUR, AND MARINE ENVIRONMENT IN JAPAN,
Bureau of Ports and Harbors, Tokyo (Japan).
T. Ikeda.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./ Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 12-29, 12 fig, 1 tab.

Descriptors: *Legal aspects, *Water pollution control, *Harbors, *Japan, *Marine environment, *Water quality control, Water pollution control, Water sampling, Water pollution, Water quality standards, Chemical oxygen demand, Biological oxygen demand, Rivers, Lakes.

Environmental pollution in Japan progressed rapidly during the period of high economic growth beginning in 1960. In response to strong social demands for the prevention of pollution, pollution control measures progressed rapidly in the 1970s and the worst cases of environmental pollution were eased. The conservation of energy and resources also progressed while the economy shifted from high growth to stable growth. Today, environmental pollution is gradually lessening. Outlined is the current situation of water pollution in Japan, as expressed by the rate of achievement of environmental water quality standards (health items and living environment items). The results of measurement of water quality in public marine areas in fiscal year (FY) 1982, show that the proportion of samples not meeting the environmental quality standards (percentage of nonconformity) was 1.4% in FY 1970 but decreased to 0.3% in FY 1982, showing a considerable improvement. For the living environment, 67.5% of the marine areas achieved the environmental quality standard for the typical water quality index of biochemical oxygen demand (BOD) or chemical oxygen demand (COD). In detail, 81.3% of the sea areas, 65.3% of the rivers, and 41.7% of the lakes achieved the quality standard. Twenty anti-pollution laws were established during the 6-month session of the Diet beginning in late 1970, which was called the 'Anti-pollution Diet.' Thereafter, various additional laws were formulated and many legal restrictions enacted. The legal system covering the environmental conservation of ports, harbors, and marine environment is discussed. (See also W87-03248) (Lantz-PTT)
W87-03249

MODEL OF NITROGEN RELEASE FROM BOTTOM SEDIMENTS,
National Inst. for Environmental Studies, Tsukuba (Japan). Lab. of Freshwater Environment.
For primary bibliographic entry see Field 5B.
W87-03250

IDENTIFICATION OF PROMISING CONCEPTS FOR TREATMENT OF CONTAMINATED SEDIMENTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 5D.
W87-03256

DEWATERING OF BOTTOM SEDIMENTS,
Science Univ. of Tokyo (Japan).
For primary bibliographic entry see Field 2J.
W87-03261

IN SITU STREAM WATER CLARIFYING TESTS,
Japan Sediments Management Association, Kyoto.
M. Tanimoto, and T. Yoshida.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./ Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 318-327, 12 fig, 1 tab.

Descriptors: *Streams, *Water treatment, *Water quality control, Densification, Clarification, Filtration, Rivers, Shakujii River, Tokyo, Sanno River, Kasumiga Lake, Japan.

A new method has been developed to clarify stream water in situ. This method of clarifying river water in situ employs a boxlike apparatus made from steel divided into several chambers with an inclined fibrous plate in each. The stream flowing inside the apparatus is subjected to downward flow by the sloped plate. At the bottom edge of the plate, the suspended solids in the stream are densified. Then the stream line is changed to an upward flow, where the stream water is clarified because some of the densified solids remain at the river bottom. An unwoven fiber is spread on the plate, which acts as a filter. Thus, three procedures, densification, clarification, and filtration, are performed inside the apparatus. Therefore, it is called the DCF method. Field tests using a test apparatus were conducted three times in Shakujii River (Tokyo) and Sanno River flowing into Kasumiga Lake in 1981-1984. According to the tests, the DCF method has the following attributes: (1) no energy; (2) no labor; (3) very simple construction; (4) very low investment cost; and (5) very high clarifying capability. In general industrial water treatment, a filtration procedure is applied to the clarification of water having less than 20 mg/L suspended solids concentrations. Clarification by the DCF apparatus lies in this range of industrial filtration. It is reasonable to note that good results were attained when comparing industrial filtration techniques with the simple device of the DCF method. Consequently, the feasibility of the DCF method seems to hold promise. (See also W87-03248) (Lantz-PTT)
W87-03265

PURIFICATION OF NHO RIVER BY THE GRAVEL CONTACT METHOD,
Ministry of Construction, Tokyo (Japan). Kanto Regional Construction Bureau.
M. Kobayashi, and T. Kiriku.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./ Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 328-356, 15 fig, 5 tab.

Descriptors: *Nho River, *Water pollution treatment, *Gravel, Tama River, Water treatment facilities, Performance evaluation.

The Nho River, a tributary of the Tama River, Japan is polluted heavily by wastewater, and is causing deterioration of the water quality of the main river. The Nho River Purification Facility intends to help improve the Tama River water quality by purifying the Nho River and discharging the purified water to the Tama River. The purification method called 'Gravel Contact Purification' (GCP) is used to artificially raise the natural purification potential. Since the Tama River has a wide river terrace and an abundant gravel resource, this method is applicable to the purification facility at Nho River. Application of the GCP method on the Nho River is the first practical use of the method in Japan. The polluted influent water from the Nho River will flow through the gravel laid under the terrace of the Tama River, and, as a result, organic matter in the water will be removed. The construction of the Nho River Purification Facility, located at off-Kamata, Setagaya District of Tokyo, upstream of Shin-Futako Bridge, began in November 1981 and was completed 2 years later in July 1983 at a cost of 640 million yen. The advantages of the purification facility are as follows: (1) Saves resources. The main material, 21,400 cu m of gravel, was available at the construction site of Tama River; (2) Saves energy. The difference of levels at the intake and discharge points is utilized for the gravitational flow and no energy is input to the system; (3) Maintenance free. With ordinary purification systems, the maintenance problems including the disposal of generated sludge are troublesome, while with this facility the sludge is decomposed and deposited naturally; and (4) Utilization of surface area. When the gravel bed is covered by earth, the surface can be used for recreational purposes such as a playground and plaza for the people. The facility has proved its expected usefulness without much maintenance. On the other hand, the burden related to cleaning the inlet has been greater than foreseen initially. Also unexpected were the appearance of large amounts of scum in the pond and the generation of hydrogen sulfide odor from the gravel beds. Even though the facility is operating normally, at present, unexpected happenings may still occur, partly due to the lack of experience. (See also W87-03248) (Lantz-PTT)
W87-03266

ENVIRONMENTAL CONSERVATION IN THE PORT OF MAIZURU,
Kyoto Civil Engineering and Construction Dept. (Japan).
For primary bibliographic entry see Field 5B.
W87-03269

ENVIRONMENTAL AND WATER QUALITY OPERATIONAL STUDIES (EWQOS) - APPLICATION TO LAKE RESTORATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
J. L. Mahloch.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./ Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 403-414, 5 fig, 1 tab, 22 ref.

Descriptors: *Water quality, *Water quality management, *Lake restoration, Reservoirs, Inland waterways, Management planning, Aeration, Water quality control, Destratification, Algal growth.

EWQOS is the largest funded U.S. Army Corps of Engineers research program directed at solving the environmental quality problems of reservoirs and inland waterways. Application of EWQOS technology to lake restoration falls into two categories: (a) evaluation for management decisions, and (b) specific techniques for improving environmental quality. Management decisions revolve around the ability to predict or monitor the response of a lake to proposed restoration techniques. Specific techniques to improve lake water quality such as aeration, destratification, and localized mixing were also developed under the EWQOS Program, and design procedures are available. A common manifestation of lake water quality problems is the appearance of nuisance algae blooms. Research in EWQOS has produced a review of common algal control techniques, algae succession data in response to eutrophy, and a new technique using destabilization and nutrient additions to promote the dominance of more desirable algal species. Many of the techniques applicable to lake restoration have been field tested or verified under EWQOS to facilitate their implementation. (See also W87-03248) (Author's abstract)
W87-03271

TREND ANALYSIS OF WATER QUALITY IN THE SABARMATI RIVER AT AHMEDABAD FOR A DECADE (1969-1978),
Council of Scientific and Industrial Research, New Delhi (India).
P. S. Datta.

IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 71-77, 4 fig, 3 tab, 1 ref.

Descriptors: *Water quality, *Sabarmati River, *India, Ahmedabad, Seasonal variation, Rivers, Distribution patterns, Water quality control, Path of pollutants, Water analysis, Chemical analysis.

Seasonal variation of the dissolved chemical constituents in the Sabarmati River and trend analysis of its quality at Ahmedabad, Gujarat State, India, is reported. The quality of river water deteriorates from north to south, with considerable deterioration and remarkable seasonal variation downstream of Ahmedabad. Chemograph responses at Ahmedabad show lag or lead effects with respect to rise in discharge. Comparison of annual cumulative distribution curves of dissolved constituents in the river water at Ahmedabad indicates that there is a 75% probability of its remaining below 372 mg/L. (See also W87-03272) (Author's abstract)
W87-03278

STATISTICAL ANALYSIS OF THE RELATIONSHIP BETWEEN WATER QUALITY PARAMETERS AND DISCHARGE AT EIGHT STATIONS ON THE RHINE FROM 1959 TO 1974 (ANALYSE STATISTIQUE DES RELATIONS LIANT LES PARAMETRES DE QUALITE D'EAU ET LE DEBIT DU RHIN EN HUIT STATIONS DE 1959 A 1974),
Electricite de France, Chatou.
C. Sabaton.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 109-119, 4 fig, 1 tab.

Descriptors: *Statistical analysis, *Water quality, *Rhine River, Water sampling, Biological oxygen demand, Ammonia, Hydrogen ion concentration, Oxygen, Nitrates, Temperature, Flow discharge.

In this study, water quality data collected at eight stations on the Rhine from 1959 to 1974 have been analyzed. Statistical analysis of measured concentrations shows a certain homogeneity in data structure for downstream stations (from Braubach to the delta area) with significant covariations between discharge, BOD5 concentrations, NH4 concentrations, KMNO4 oxidability and pH (low discharge corresponding to low pH, high NH4 and BOD5 concentrations, high KMNO4 oxydability and vice versa). Only dissolved oxygen and nitrates seem to be linked with temperature. In order to determine if covariations between discharge and the different concentrations are in fact connected with dilution, a statistical analysis of computed fluxes has been carried out. At each station very significant correlations are apparent between discharge and the flux of the following parameters: BOD5, KMNO4, NO3 and dissolved oxygen. It appears that the hypothesis of constant input year round, is not acceptable. On the contrary, the higher the discharge, the higher the input flux seems to be. (See also W87-03272) (Author's abstract)
W87-03282

REGIONAL ANALYSIS OF WATER QUALITY IN MAJOR STREAMS OF THE UNITED STATES,
Woodward-Clyde Consultants, Englewood, CO.
T. D. Steele.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 131-143, 6 fig, 2 tab, 22 ref.

Descriptors: *Water quality, *Regional analysis, *Streams, History, Inorganic compounds, Temperatures, Regression analysis.

The National Stream Quality Accounting Network (NASQAN), established by the US Geological Survey in 1973, is designed to describe quantitatively the quality of the major rivers of the United states on a systematic and continuing basis. Historical data collected at 88 long-term water quality sites were evaluated relative to their suitability for depicting general areal variability and time trends of major inorganic chemical constituents. Many of these sites are included among the current 517-site NASQAN program. More recent data from this network were used to characterize stream temperatures. Using the 88-site historical data, regression relationships between major inorganic constituent concentrations and specific conductance or discharge were developed, and water quality conditions were related to regional geological features and physiographic provinces. Based upon variation in and distribution of regression coefficients, regional regression equations which provide estimates of water quality of surface waters are presented for major regions of the nation. For selected sites, examples are shown for assessing time trends in historical water quality data. (See also W87-03272) (Author's abstract)
W87-03284

EFFECTS OF HYDRAULIC PROJECTS AND THEIR MANAGEMENT ON WATER QUALITY,
Electricite de France, Chatou. Direction des Etudes et Recherches.
For primary bibliographic entry see Field 6G.
W87-03297

ROLE OF DETENTION BASINS FOR STORMWATER QUALITY CONTROL,
Princeton Univ., NJ. Dept. of Civil Engineering.
R. A. Ferrara.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 371-376, 3 fig, 1 tab, 3 ref.

Descriptors: *Detention reservoirs, *Water quality control, *Storm water, Field tests, Monitoring, Water quality standards, Effluent, Influent, Mathematical models, Reservoir design, Sedimentation.

A comprehensive analysis of the effectiveness of detention basins for storm water quality control is reported. The study consisted of three phases: (a) a field monitoring program identifying influent and effluent water quality; (b) laboratory storm water pollutant settleability tests, and (c) mathematical modelling of detention basins. The first phase provided data on time-variable influent and effluent concentrations, and therefore yielded a measure of the actual pollutant reduction obtained via detention. Phase two identified the appropriate detention time to achieve maximum particle removal through sedimentation. Phase three developed a methodology for design and analysis of storm water detention basins for both quantity and quality control. (See also W87-03272) (Author's abstract)
W87-03301

NITRATE LOAD/DISCHARGE RELATIONSHIPS AND NITRATE LOAD TRENDS IN DANISH RIVERS,
Miljoestyrelsen, Copenhagen (Denmark).
For primary bibliographic entry see Field 5B.
W87-03302

PRINCIPLES UNDERLYING THE DEVELOPMENT OF WATER QUALITY MONITORING SYSTEMS IN HUNGARY,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
For primary bibliographic entry see Field 7A.
W87-03303

CURRENT STATE OF OHIO'S WATER LAW FROM A JUDICIAL AND ADMINISTRATIVE PERSPECTIVE: CASE STUDIES AND DISCUSSION,
Ohio Office of the Attorney General, Columbus. Environmental Law Section.
For primary bibliographic entry see Field 6E.
W87-03314

MOVING TOWARD A COORDINATED GROUNDWATER MANAGEMENT APPROACH - A LEGISLATIVE PROPOSAL,
Knepper, White, Arter and Hadden, Columbus, OH.
For primary bibliographic entry see Field 6E.
W87-03315

STATISTICAL METHODS FOR RESERVOIR WATER QUALITY INVESTIGATIONS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
For primary bibliographic entry see Field 7C.
W87-03322

PLAN FOR PROTECTING ILLINOIS GROUNDWATER.
Illinois State Environmental Protection Agency, Springfield.
For primary bibliographic entry see Field 6B.
W87-03331

EFFECTIVENESS OF CAPPING IN ISOLATING DUTCH KILLS SEDIMENT FROM BIOTA AND THE OVERLYING WATER,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
J. M. Brannon, R. E. Hoeppel, T. C. Sturgis, I. Smith, and D. Gunnison.
Available from the National Technical Information Service, Springfield, VA. 22161. Miscellaneous Paper D-86-2, June 1986. Final Report. 33 p, 4 fig, 16 tab, 27 ref, append.

Descriptors: *Capping, *Dutch Kills Channel, *Water quality control, *New York, New York Harbor, Sediments, Polychaetes, Buttermilk Channel, Aquatic environment, Waste disposal, Trichlorobiphenyls, Water pollution effects, Chemical analysis, Tissue analysis.

The effectiveness of capping in chemically and biologically isolating contaminated dredged material was investigated using large- (250 L) and small- (22.6 L) scale laboratory reactor units. Buttermilk Channel cap material was evaluated for its efficiency in preventing transfer of contaminants from Dutch Kills sediment into the overlying water column and biota. In the presence of bioturbating polychaetes (Nereis virens) at densities of 100 large animals per square meter, a 50-cm cap of Buttermilk Channel sediments in the large chamber experiment was effective in preventing the transfer of chemical constituents to the overlying water and nonburrowing biota. Chemical analysis of polychaete tissue and visual observation showed that the polychaetes penetrated both the 10-cm and 50-cm caps of Buttermilk Channel sediments. Mercenaria in experimental units with a 10-cm cap (with polychaetes) showed significantly increased total trichlorobiphenyl body burdens following material. No significant difference was found between uptake of total trichlorobiphenyls by Mercenaria exposed to Buttermilk Channel and uncapped Dutch Kills sediment. These results indicate that a 50-cm cap and a 10-cm cap of Buttermilk Channel sediment, even when penetrated by organisms, are effective in preventing the transfer of chemical constituents to the overlying water and biota during a 40-day experiment. Microbial spores, which are not subject to the same adsorption reactions as dissolved chemicals, were found in higher number in the water column of experimental units with either 10-cm or 50-cm caps compared with Buttermilk Channel cap material alone. The number of spores in the water column of all treatments, however, tended to decrease steadily over time. (Lantz-PTT)
W87-03332

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

EFFECT OF RAINFALL EXCESS CALCULATIONS ON MODELED HYDROGRAPH ACCURACY AND UNIT-HYDROGRAPH PARAMETERS,
Geological Survey, Urbana, IL. Water Resources Div.
For primary bibliographic entry see Field 2B.
W87-02623

MODELS FOR WATER AND POWER SCHEDULING FOR THE CALIFORNIA STATE WATER PROJECT,
California State Dept. of Water Resources, Sacramento.
M. H. Sabet, and J. Q. Coe.
Water Resources Bulletin WARBAQ, Vol. 22, No. 4, p 587-596, August 1986. 7 fig, 8 ref.

Descriptors: *Scheduling, *Computer models, *Water management, *California, Optimization, Simulation, Networks, Computer programs, Systems analysis, Reservoir storage, Load distribution, Pumping plants.

A large-scale simulation/optimization model provides schedules for operation of water and power for the California State Water Project (SWP) which consists of a series of reservoirs linked by rivers, pumping plants, canals, tunnels and generating plants. The model performs hydraulic and electrical computations to optimize system operations. The model consists of hydraulic network programming components to meet the storage objectives of the reservoirs, a linear programming component to determine schedules at pumping and generating plants, an electrical network programming component and other simulation tools. This model operates yearly, weekly and daily, and is used for real-time operation of the SWP to provide detailed hourly schedules which are implemented by the SWP staff via a computerized system. (Author's abstract)
W87-02626

MODELING NORTH CASCADES ANNUAL RUNOFF DISTRIBUTION USING DRAINAGE BASIN ELEVATION DISTRIBUTION,
Seattle City Light Dept., WA.
For primary bibliographic entry see Field 2E.
W87-02627

EVALUATION OF WEEKLY AND MONTHLY TIME SERIES FORECASTS OF MUNICIPAL WATER USE,
Brazos River Authority, Waco, TX.
S. L. Franklin, and D. R. Maidment.
Water Resources Bulletin WARBAQ, Vol. 22, No. 4, p 611-621, August 1986. 8 fig, 6 tab, 11 ref.

Descriptors: *Municipal water, *Forecasting, *Time series analysis, *Water use, Rainfall, Parametric hydrology, Mathematical equations, Seasonal distribution.

A cascade model is conditioned on rainfall estimated for forecasting municipal water use one week or one month in the future. The increased forecasting accuracy obtained by addition of such components as long term trend, seasonal cycle, autocorrelation and rainfall correlation is evaluated. Deerfield Beach, Florida is used as the municipal application area with a calibration period from 1976 to 1980 and the forecast period of the drought year of 1981. Forecast accuracy is measured by the average absolute relative error (AARE) which is the average absolute value of the difference between actual and forecasted use, divided by actual use. A benchmark forecast is calculated by assuming that weekly or monthly water use in 1981 is the same as the average for the corresponding period from 1976 to 1980. An AARE of 14.6% for one step ahead forecasts of monthly data and 15.8% for weekly data was produced. Application of trend, seasonality and autocorrelation produced forecasts with a 12% AARE for monthly and weekly data while adding a linear relationship of water use and rainfall reduces AARE to 8% if rainfall is known during the forecast period. Simple rainfall predictions do not increase water use forecast accuracy, so the major benefit of relating water use to rainfall lies in forecasting various possible water use sequences condidtioned on sequences of historic rainfall data. (Michael-PTT)
W87-02629

USE OF CLIMATE PREDICTIONS TO DECIDE A WATER MANAGEMENT PROBLEM,
Illinois State Water Survey Div., Champaign.
S. A. Changnon, and D. R. Vonnhame.
Water Resources Bulletin WARBAQ, Vol. 22, No. 4, p 649-652, August 1986. 1 fig, 1 tab, 6 ref. NSF Grant No. ATM 8413043.

Descriptors: *Prediction, *Rainfall forecasting, *Climatic data, *Water management, *Decision making, *Drought, Probabilistic process, Precipitation, Water use, Value, Illinois.

The use of probabilistic precipitation predictions in water management decisions is presented. The decision-maker can use available prediction and its uncertainties within the context of other hydrologic, economic and socio-political factors influencing the decision process. A summer drought in Illinois had created a situation requiring full season use of state waters from two multi-purpose reservoirs with an ensuing effect on water price negotiations. Choices facing water managers were to either invoke water restrictions (with a 33% chance of being right), do nothing (66% chance of wrong outcome) or use precipitation predictors for above normal fall rain (50% chance of error). Hydrologists chose to follow the precipitation predictors which proved to be accurate for that fall. This case illustrates the value of using well understood climate predictions for water resources management. (Michael-PTT)
W87-02633

CHUBB/BAUMAN METHOD FOR ESTIMATING THE RECREATION POTENTIAL OF RIVERS: A CRITICAL REVIEW,
Calgary Univ. (Alberta). Dept. of Geography.
L. Hamill.
Water Resources Bulletin WARBAQ, Vol. 22, No. 4, p 653-659, August 1986. 1 tab, 19 ref.

Descriptors: *Chubb/Bauman method, *Recreation, *Rivers, *Estimating, Quantitative analysis, Computer programs, Prediction, Modeling, Statistical analysis, Performance evaluation.

Concepts and procedures of the Chubb/Bauman (Ch/B) method for quantitative estimation of the recreation potential of rivers are evaluated in a comparison with other available methods for recreation resource inventory. The Ch/B method collects information on 67 variables and uses a computer program to produce estimates of potential for 16 common recreation activities. The validity and utility of numerical weighting of variables, the use of numbers derived from place in a classification and the transformation process are considered. The Ch/B method's quantitative techniques appear to exhibit serious flaws in that much of the data produced only appears to be quantitative and the method does not produce truly quantitative estimates of recreation potential. Classifications of generalized geographic or environmental variables are shown to have serious defects as a basis for evaluating recreation potential. (Michael-PTT)
W87-02634

SOIL POTENTIAL RATINGS FOR ONSITE WASTEWATER DISPOSAL,
Satterthwaite Associates, Inc., West Chester, PA.
For primary bibliographic entry see Field 5E.
W87-02860

METEOROLOGICAL DATA ANALYSIS FOR DRAINAGE SYSTEM DESIGN,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2B.
W87-02882

SIZING SUBMERSIBLE PUMPS,
For primary bibliographic entry see Field 8C.
W87-02927

MINIMIZING THE COST OF COPING WITH DROUGHTS: SPRINGFIELD, ILLINOIS,
Southern Illinois Univ. at Carbondale. Dept. of Geography.
For primary bibliographic entry see Field 6D.
W87-03057

PLANNING AND TECHNOLOGY IN SANITARY AND ENVIRONMENTAL ENGINEERING,
Johns Hopkins Univ., Baltimore, MD. Dept. of Sanitary Engineering and Water Resources.
A. Wolman.
PAHO Bulletin, Vol. 20, No. 1, p 45-52, 1986. 7 ref.

Descriptors: *Sanitary engineering, *Environmental engineering, *Wastewater treatment, World Health Organization, Public health, Management planning, Public participation, Ecology.

Challenges presented to the wastewater treatment industry by passage through and important transitional era in the world's environment are discussed, including the difference between the 'old' and 'new' worlds; the responsibilities of the waterworks industry, industry at large; and the potable water industry; and current disabilities and constraints. The current global situation of water supply and sanitation as assessed by the World Health Organization and comments on planning also are covered. Factors of importance in planning include sector relationships, financial resources, community participation, appropriate technology, and ecology. (Rochester-PTT)
W87-03098

EXISTENCE VALUES AND NORMATIVE ECONOMICS: IMPLICATIONS FOR VALUING WATER RESOURCES,
Wyoming Univ., Laramie. Dept. of Economics.
For primary bibliographic entry see Field 6B.
W87-03188

VALUE OF HISTORICAL DATA IN FLOOD FREQUENCY ANALYSIS,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 2E.
W87-03200

6B. Evaluation Process

ADAPTING INDUSTRIAL APPROACHES TO MUNICIPAL WASTEWATER TREATMENT PROBLEMS,
Engineering-Science, Inc., Atlanta, GA.
For primary bibliographic entry see Field 5D.
W87-02905

FINANCIAL PLANNING MODEL AND ITS APPLICATION,
North Carolina Univ. at Chapel Hill. Dept. of City and Regional Planning.
D. H. Moreau.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 4, p 439-452, October 1986. 6 tab, 8 ref.

Descriptors: *Financial planning *Water costs, *Cost analysis, *Model studies, Inflation, Operating costs, User charges, Water treatment facilities, Mathematical models, Revenue models, Revenues, Economic aspects, Water control.

The development of a financial planning model for publicly-owned water and sewer utilities is reported. It was developed for and used by the Orange

Water and Sewer Authority (OWSA), which serves Chapel Hill and Carrboro, North Carolina. The model was formulated as a linear programming problem, whose solution generates a set of effective prices and bond issues over multiple time periods. Constraints include minimum annual balances, minimum annual net revenues, limits on arbitrage, controls on price variations, and limits on borrowing. The primary benefit of the model is to provide insight into the consequences of present decision, thereby not commiting the Authority to a set of decisions over the next ten years. Results of the model indicated that, in the particular case of OWASA, the capital improvement program and increased operating costs could be financed with increases in consumer prices that would be quite acceptable. This same conclusion is probably not applicable to a large number of municipalities. Two factors make the OWASA situation atypical. First, OWASA was one of the last public water and sewer operations to receive a 75% federal and 12.5% state construction grant for its waste treatment plant. Without those grants, rates would have been increased sharply. And second, because of lengthy delays in federal and state permit processes for the new water supply, OWASA has accumulated a substantial reserve fund for new construction, amounting to nearly $5,000,000. This relatively large initial balance makes the difference among alternative schedules of capital improvements and financing strategies less important than they would be otherwise. It also eliminated the need for large sudden increases in consumer prices. (Lantz-PTT)
W87-03058

COMPLEXITY IN COLUMBIA RIVER SYSTEMS MODELING,
Washington Univ., Seattle. Dept. of Civil Engineering.
R. N. Palmer, and J. L. Cohan.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 4, p 453-468, October 1986. 8 fig, 4 tab, 17 ref. Department of the Interior Grant G-876, and State of Washington Water Research Center Project No. A-0121-WASH.

Descriptors: *Computer models, *Water resources development, *Cost analysis, *Management planning, *Columbia River, Model studies, Fish, Monte Carlo method, Hydroelectric power, Simulation analysis, Environmental effects.

The problem of model complexity in evaluating the tradeoffs between fish and power production on the Columbia River is reviewed. Characterizations of model complexity are presented, and appropriate levels of model complexity are discussed. Models currently used (PNCA seasonal regulation program; Hydroelectric power planning program; Hydro system seasonal regulation program, WSU Snake-Columbia Basin simulation model; Stanford composite potential energy model; COE pondage program; BPA bondage program; Loss of load probability analysis; PP&L reliability model; Energy reserve planning model; and BPA's one-reservoir model) to investigate the conflict between fish and hydropower production in the Columbia River Basin are reviewed. It is concluded that the complexity of the models used to generate tradeoffs between conflicting uses of water in this setting hinder their successful application and, because of their reliance on historic streamflow records, do not adequately address the problem in a probabilistic framework. To demonstrate the value of a simplified model, the operation of an equivalent composite reservoir was simulated. After calibration of the simplified model (CRISP), a series of Monte Carlo simulations were run to indicate possible impacts of alternative operational strategies on firm and secondary power and average annual generation. (Author's abstract)
W87-03059

DROUGHT AND POWER PRODUCTION,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6D.
W87-03060

RISK INFORMATION FOR FLOODPLAIN MANAGEMENT,
Utah Water Research Lab., Logan.
For primary bibliographic entry see Field 6F.
W87-03061

DECISION SUPPORT SYSTEM FOR LOCAL WATER MANAGEMENT,
Portland State Univ., OR. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6D.
W87-03064

COMPARISON OF VARIOUS METHODS OF CONTROLLING THE LONG-TERM OPERATING REGIMES OF HYDROELECTRIC STATIONS,
For primary bibliographic entry see Field 8C.
W87-03176

LOW-HEAD PUMPED-STORAGE STATION AS A WAY OF EXPANDING THE TSIMLYANSK HYDROELECTRIC STATION,
For primary bibliographic entry see Field 8C.
W87-03182

EXISTENCE VALUES AND NORMATIVE ECONOMICS: IMPLICATIONS FOR VALUING WATER RESOURCES,
Wyoming Univ., Laramie. Dept. of Economics.
D. S. Brookshire, L. S. Eubanks, and C. F. Sorg.
Water Resources Research WRERAQ, Vol. 22, No. 11, p 1509-1518, October 1986. 1 tab, 46 ref.

Descriptors: *Water resources development, *Resources development, *Economic evaluation, Resource allocation, Cost-benefit analysis.

Resource valuation techniques have evolved dramatically over the years, and understanding the accuracy of these methods has increased greatly. As a result, the range of resources that potentially can be valued has been expanded. Additionally, the increasing recognition of a larger array of appropriate benefits such as use, option, altruistic, preservation, bequest, intrinsic, and existence values has greatly expanded the possible applications of benefit-cost analysis. Resources trade-offs predominantly involving issues of preservation versus development can now be viewed as being susceptible to analysis. Preservation of scenic rivers, white water rafting, instream flows for habitat maintenance, and water quality are only a few examples that would have been viewed as conceptually beyond formal benefit-cost analysis just 10 years ago. The definitional issues and conceptual framework of existence value are explored. It is argued that existence value may have two components: (1) an economic component that is consistent with utility maximizing behavior and (2) an ethical component that is inconsistent with normative benefit-cost assumptions. Issues as how to appropriately include a measure of existence value within a utility maximizing framework are also explored. Difficult conceptual problems arise out of this discussion. Caution is suggested to the water resources analyst in including existence value within an economic framework. (Lantz-PTT)
W87-03188

REVIEW OF SELECTIVE WITHDRAWAL PERFORMANCE IN THE FORT WORTH DISTRICT,
Army Engineer District, Fort Worth, TX.
R. Turner.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 48-52, 1 tab.

Descriptors: *Selective withdrawal, *Fort Worth, *Performance evaluation, *Water quality control, Texas, Lakes, Seasonal variation, Temperature, Model studies, Dam design.

The Fort Worth District has built or currently has under construction a total of 25 lakes. Of these, three are currently under construction. The construction of these lakes has been accomplished over a time span of 30 years. The District constructed 8 lakes in the early 1950's, and two of these had capability for selective withdrawal from three or four elevations in addition to the flood control conduit. A third lake constructed in this period had a single low flow intake or elevation which differed from the flood control conduit. The paper describes the type of structures designed during that period and the basis for their design, and includes available historic data on release water quality. This review of the lakes in the Fort Worth District leads to the conclusion that the selective withdrawal facilities on those lakes for which they were provided, have justified the cost of their construction. Several of the lakes which have no facilities for selective withdrawal have not been discussed individually. The project managers on those lakes which were interviewed indicated no problems with poor water quality from those lakes, except most did agree that some odor could be detected in the late fall when the lake turned over. Therefore, it would seem that the decision not to include the selective withdrawal facilities of the shallower lakes would also be justified. Aquilla lake, the only shallow lake for which a temperature model was used in the design, was not equipped with selective withdrawal facilities because the study indicated that the lake could be successfully operated without them. (See also W87-03221) (Lantz-PTT)
W87-03229

SELECTIVE EXPERIENCES: ALIAS WITHDRAWAL PAINS,
Corps of Engineers, Huntington, WV. Huntington District.
R. E. Punnett.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 165-170, 1 tab.

Descriptors: *Selective withdrawal, *Performance evaluation, *Water quality control, *Deer Creek Lake, *Alum Creek Lake, *Paint Creek Lake, *Beech Fork Lake, *Burnsville Lake, *East Lynn Lake, *R.D. Bailey Lake, *Sutton Lake, *Fishtrap Lake, *Grayson Lake, *Paintsville Lake, Temperature, Engineering, Water management, Ohio, West Virginia, Kentucky.

Three Corps of Engineer projects were located in the central part of Ohio, (Alum Creek, Deer Creek, and Paint Creek Lakes), five were located throughout West Virginia (Beech Fork, Burnsville, East Lynn, R.D. Bailey, and Sutton Lakes), and three were located in eastern Kentucky (Fishtrap, Grayson, and Paintsville Lakes). All projects were within the Huntington District. For the evaluation, the release characteristics for the years 1982, 1983, and 1984 were used. For each project, a temperature objective curve was determined based on natural stream temperatures. Releases were managed so as to stay, when possible, within a temperature deviation of two degrees Fahrenheit either above or below the objective curve. The temperature regulation program within the Huntington District was discussed. Some generalized observations for design guidance was given. It was determined that good engineering design begins with good design criteria. The price of good engineering is paid for, regardless of whether or not it was received. The release temperature objective, while important, may not be a sufficient design criterion. The true objective should be to maintain a productive as well as viable downstream habitat. (See also W87-03221) (Lantz-PTT)
W87-03246

OHIO WATER LAW: PRESENT ASPECTS OF OHIO WATER POLICY,
Ohio Dept. of Natural Resources, Columbus. Div. of Water.
For primary bibliographic entry see Field 6E.
W87-03313

MOVING TOWARD A COORDINATED GROUNDWATER MANAGEMENT APPROACH - A LEGISLATIVE PROPOSAL,
Knepper, White, Arter and Hadden, Columbus, OH.
For primary bibliographic entry see Field 6E.
W87-03315

PLAN FOR PROTECTING ILLINOIS GROUNDWATER.
Illinois State Environmental Protection Agency, Springfield.
January 1986. 65 p, 9 fig, 1 tab, 2 append.

Descriptors: *Illinois, *Groundwater management, *Management planning, *Water quality protection, *Water pollution control, *Water resources development, Groundwater, Groundwater pollution.

Water resource protection is a major concern to the citizens of Illinois. Contamination has been detected in nearly all portions of the State. The national focus upon groundwater quality has prompted the U.S. Environmental Protection Agency to issue Groundwater Protection Strategy. The issue was also brought to the attention of the State Water Plan Task Force in 1981. The Task Force issued a 'Strategy for the Protection of Underground Water in Illinois', recommending a coordinated multi-agency policy and framework for action. The Illinois General Assembly recognized the pervasive need to accomplish a statewide problem assessment and to develop an action plan. Public Act 83-1268 was passed to respond to the need to monitor, assess, and resolve groundwater problems and develop a unified statewide groundwater protection plan. This document responds to that mandate and proposes a core program to prevent future contamination of groundwater and to correct current problems. This program, which would work over a five-year period, consists of five parts, to: (1) Clarify the goals and objectives for groundwater protection in Illinois; (2) Operate appropriate groundwater monitoring programs; (3) Continue to address suspected and/or known groundwater contamination problems; (4) Implement technology-based programs for Land Pollution Control; and (5) Establish a Statewide program for groundwater source protection. (Lantz-PTT)
W87-03331

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

EMERGING TRENDS IN INFRASTRUCTURE FINANCING,
Congressional Budget Office, Washington, DC. Natural Resources and Commerce Div.
D. L. Bodde.
Journal of the American Water Works Association JAWWA5, Vol. 77, No. 11, p 53-56, November 1985. 6 fig, 5 ref.

Descriptors: *Infrastructure financing, *Economic aspects, *Government finance, Legislation, Wastewater, Wastewater treatment.

Constrained budgets at the federal level indicate that state and local governments are going to have to assume a larger share of infrastructure spending. This has been true historically for water supply, for which federal funding has never played a dominant role, and is becoming increasingly likely for wastewater treatment as well. The limited federal assistance that might become available could take two forms: (1) targeted aid to economically distressed areas, and (2) unrestricted aid through block grants and revolving loans funds. Because congressional consideration of these matters remains incomplete, water supply and wastewater treatment managers have an opportunity to contribute to the legislative process. (Author's abstract)
W87-02606

ESTIMATION OF WASTEWATER TREATMENT COSTS: EVALUATION OF THE CAPDET MODEL FOR CANADIAN CONDITIONS,
For primary bibliographic entry see Field 5D.
W87-02670

DISTRIBUTION OF ECONOMIC RENTS ARISING FROM SUBSIDIZED WATER WHEN LAND IS LEASED,
California Univ., Davis. Dept. of Agricultural Economics.
R. G. Huffaker, and B. D. Gardner.
American Journal of Agricultural Economics, Vol. 68, No. 2, p 306-312, May 1986. 2 tab, 14 ref.

Descriptors: *Water supply, *Water distribution, *Subsidies, *Economic rent, *Leases, Federal jurisdiction, Statistical analysis, Land tenure, Mathematical equations, Statistical models, Economic aspects, Reclamation Reform Act.

Broad distribution of the benefits of federally subsidized water can be promoted by limiting the size of owned acreage and not the sum of owned and leased acreage as required by the Reclamation Reform Act of 1982. Calculated differences between contractual lease payments and tenant expected economic rents were statistically tested to determine if landowners fully capture economic rents. Cash lease markets transferred nearly all economic rents expected by tenants to landowners in the study area. Share lease markets perform similarly if share tenants are assumed to be moderately risk averse. (Author's abstract)
W87-02874

PUMP STATION GETS NAVY DISCHARGE AND NEW LIFE AS CIVILIAN,
Tatman and Lee Associates, Wilmington, DE.
For primary bibliographic entry see Field 5F.
W87-02925

VOTER REACTIONS TO THE 1976 WATER DEVELOPMENT AND QUALITY REFERENDA IN TEXAS,
University of Southern California, Los Angeles. Dept. of Geography.
For primary bibliographic entry see Field 6E.
W87-02944

FINANCIAL PLANNING MODEL AND ITS APPLICATION,
North Carolina Univ. at Chapel Hill. Dept. of City and Regional Planning.
For primary bibliographic entry see Field 6B.
W87-03058

6D. Water Demand

WATER USE IN URBAN KOREA,
Commonwealth Scientific and Industrial Research Organization, Port Melbourne (Australia). Div. of Mineral Chemistry.
R. M. Bradley.
Effluent and Water Treatment Journal EWTJAG, Vol. 25, No. 10, p 348-354, October 1985. 7 fig, 6 tab, 13 ref.

Descriptors: *Water use, *Korea, *Seoul, *Chuncheon, *Weonju, *Prediction, *Domestic water, Water survey, Water demands, Planning, Urban areas, Water rates.

The primary objectives of a water use survey are to prepare input and output water balances for various residential developments and to obtain water use data for a range of socio-economic levels and housing types suitable for predicting future demands resulting from planned improvements to the housing stock and from increased urbanization generally. The seven survey areas comprised a range of apartment and housing types in the capital city of Seoul and the provincial cities of Chuncheon and Weonju. The results of the surveys of domestic water use in the three cities provided data suitable for prediction of future water demands over a range of socio-economic levels. The rates were proportional to housing quality as defined by floor area and occupancy, ranging from an average 86 l/d person for nightsoil houses to 138 l/d person for septic tank houses to an average of 218 l/d person for apartments. (David-PTT)
W87-02617

IMPACTS OF WATER QUALITY IMPROVEMENT ON SITE VISITATION: A PROBABILISTIC MODELING APPROACH,
Economic Research Service, Washington, DC.
For primary bibliographic entry see Field 4D.
W87-02622

MODELS FOR WATER AND POWER SCHEDULING FOR THE CALIFORNIA STATE WATER PROJECT,
California State Dept. of Water Resources, Sacramento.
For primary bibliographic entry see Field 6A.
W87-02626

EVALUATION OF WEEKLY AND MONTHLY TIME SERIES FORECASTS OF MUNICIPAL WATER USE,
Brazos River Authority, Waco, TX.
For primary bibliographic entry see Field 6A.
W87-02629

CHUBB/BAUMAN METHOD FOR ESTIMATING THE RECREATION POTENTIAL OF RIVERS: A CRITICAL REVIEW,
Calgary Univ. (Alberta). Dept. of Geography.
For primary bibliographic entry see Field 6A.
W87-02634

LONG DISTQANCE WATER RIGHTS,
Black and Veatch, Kansas City, MO.
For primary bibliographic entry see Field 6E.
W87-02637

VIRGINIA, NORTH CAROLINA WAGE WATER-RIGHTS BATTLE,
For primary bibliographic entry see Field 6E.
W87-02638

WATER AND HYGIENE: THE CASE OF NORTH CAROLINA FARMWORKERS,
North Carolina Univ. at Chapel Hill. Dept. of Environmental Sciences and Engineering.
J. Briscoe, and W. Barron.
Journal of Environmental Health JEVHAH, Vol. 49, No. 1, p 24-27, July-August 1986. 3 tab, 18 ref.

Descriptors: *Water use, *Farm workers, *North Carolina, *Public health, *Public policy, *Water supply, *Water conveyance, Enforcement, Legislation, Legal aspects, Law enforcement, Potable water, Domestic water, Mathematical models.

A linear regression model was used to examine the determinants of reported personal hygiene practices of children in 87 migrant and seasonal farmworker families in eastern North Carolina. The results suggest that handwashing is substantially increased by ensuring that families have water piped into multiple taps in the house, and that by having access to heated water and showers, bathing of children may also be substantially increased. It is concluded that if hygiene practices of farmworkers are to be improved, enforcement of existing state and federal legislation will have to be improved and amendments to this legislation enacted. (Author's abstract)
W87-02756

PSKEM HYDRO DEVELOPMENT ON THE PSKEM RIVER,
For primary bibliographic entry see Field 8A.
W87-02870

TRAVEL COST MODEL FOR LAKE RECREATION: A COMPARISON OF TWO METHODS FOR INCORPORATING SITE QUALITY AND SUBSTITUTION EFFECTS,
Environmental Protection Agency, Washington,

DC. Economic Analysis Div.
P. P. Caulkins, R. C. Bishop, and N. W. Bouwes.
American Journal of Agricultural Economics, Vol. 68, No. 2, p 291-297, May 1986. 3 tab, 19 ref.

Descriptors: *Model studies, *Recreation demand, *Lakes, *Cost analysis, Recreation facilities, Water quality, Decision making, Travel, Mathematical models, Mathematical equations.

The effect of different assumptions regarding decision-making behavior on the predicted changes in recreational activities resulting from water quality improvements is evaluated. The principal finding of this study illustrates how different assumptions regarding recreationists' decision-making behavior may affect the predicted changes in recreational activity given a change in water quality. The multinomial logit model (MNL) specification portrays recreationists' decision-making behavior according to a 'more likely outcome,' leading to smaller increases in the additional number of day trips made, as a result of water quality improvement. The use of more conventional models in estimating recreational benefits for a proposed lake rehabilitation project, could overestimate actual benefits. Numerous issues were confronted in the empirical estimation of the two models, and the manner in which they have been addressed may influence empirical results. First, whether different demand equations are needed for different lake recreational lake activities could not be addressed in this study because of a lack of data. Second, the specification of the relevant choice sets presented problems for both models. Third, for the MNL model, the assumption that each day trip represents a decision that is independent to past or planned future visits to sites is not that plausible. The development of the Markov chain model would be preferable. Fourth, issues concerning the opportunity cost of time spent at the site and traveling to and from the site and their impacts on recreational decision making could not be addressed in this study. Finally, the subjective-objective water quality linkage could not be established empirically, and was assumed. (Lantz-PTT)
W87-02872

REVIEW AND ANALYSIS OF METHODS FOR QUANTIFYING INSTREAM FLOW REQUIREMENTS,
Alaska Dept. of Fish and Game, Anchorage.
C. C. Estes, and J. F. Orsborn.
Water Resources Bulletin WARBAQ, Vol. 22, No. 3, p 389-398, June 1986. 3 fig, 2 tab, 34 ref.

Descriptors: *Water requirements, *Reviews, *Instream flow requirements, *Instream flow methods, *Stream discharge, *Spawning habitats, *Alaska, *Salmon, *Data collection, Flow, Hydrologic data collection, Fish.

A review of instream flow methods and recommendations for their application is supplemented by a summary of a comparison of four independent analyses. The four analyses: the Physical Habitat Simulation System approach of the Instream Flow Incremental Methodology by the U.S. Fish and Wildlife Service, the Montana Method by Tenant, and two methods by Orsborn (Maximum Spawning Area Flow and Maximum Spawning Area) represent resource-intensive and simplistic data collection and analysis methods. Each analysis was used independently to determine flows to support spawning by chinook salmon (Oncorhynchus tshawytscha) in Willow Creek, Alaska. Each method can be used independently or collectively to generate instream flow recommendations, if calibrated to the site or area studied. Once adjusted methods similar to the Montana and two Orsborn methods should be used to determine flow recommendations for areas where competition for water is minimal. The Instream Flow Incremental Methodology or similar methods should be applied when competition for water is keen or when detailed evaluations of the responses of species/life phases to flow variations are required. (Author's abstract)
W87-02933

ANALYSIS AND CARTOGRAPHICAL APPROACH TO THE REGIONAL WATER UTILIZATION SYSTEM IN THE YODO RIVER BASIN,
Osaka Univ. (Japan). Dept. of Environmental Engineering.
T. Sueishi, T. Morioka, and C. Rouviere.
Ecological Modelling, ECMODT Vol. 31, No. 1-4, p 315-327, May 1986. 8 fig, 3 tab, 4 ref.

Descriptors: *Yodo River basin, *Industrial water, *Derived water, *Water supply systems, *Hydrologic budget, *Socioeconomic models, Mathematical models, Water use, Cartography.

The methodology of derived water was used in attempt to determine the water-related carrying capacity of the Yodo River basin (Japan) from the regional budget of the urban production-consumption system rather than from the budget of water supply and water discharge. The core of the study is the evaluation of the water equivalents of manufactured products at the level of final individual consumption. According to the proposed classification of products, industrial water supply is correlated to industrial output of products and their distribution, a pattern which is depicted by the hierarchical order of distribution and the delimitation of consumption areas, for each prefecture of the Yodo River basin. Data of freight, of retail and wholesale trades, of industry, and of water supply were collected. The cartographical method of water supply allocation has proved the possibility of synthesizing an aspect of regional water utilization systems. Results concerned with derived water are limited to a quantitative budget of total and local water equivalents of alimentary consumption, by prefectures, in accordance with the method of consumption areas. (Author's abstract)
W87-02978

MANAGING WATER FOR TURFGRASS,
Iowa State Univ., Ames.
For primary bibliographic entry see Field 2I.
W87-03016

MINIMIZING THE COST OF COPING WITH DROUGHTS: SPRINGFIELD, ILLINOIS,
Southern Illinois Univ. at Carbondale. Dept. of Geography.
B. Dziegielewski, and J. E. Crews.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 4, p 419-438, October 1986. 3 fig, 7 tab, 31 ref, append.

Descriptors: *Cost analysis, *Drought, *Optimum development plans, *Water shortage, *Springfield, *Water supply development, Management planning, Decision making, Case studies, Hydrologic regime, Economic aspects, Illinois.

Past drought experiences show that the failure of water supply systems to meet demands during droughts can be reasonably described in terms of the tangible monetary expenditures and economic losses related to emergency actions. A framework is presented that allows planners of water supply systems, and utility managers, to formulate least-cost drought emergency plans, and to systematically examine the trade-off between the expected value of the long-term cost of coping with water supply deficits and the cost of the long-term water supply system of Springfield, Illinois. The analysis shows that the optimal short-term programs for the mitigation of potential shortages of water during droughts, consist of a combination of moderate demand and loss reduction measures coupled with intensive utilization of emergency water supply systems. However, the choice of demand reduction measures should involve a certain degree of discrimination among various user sectors in order to avoid substantial losses to the local economy. (Author's abstract)
W87-03057

DROUGHT AND POWER PRODUCTION,
Washington Univ., Seattle. Dept. of Civil Engineering.
R. N. Palmer, and J. R. Lund.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 4, p 469-484, October 1986. 5 fig, 3 tab, 17 ref. Electric Power Research Inst. Project No. RP 2194-1.

Descriptors: *Drought, *Water shortage, *Hydroelectric power, *Water demand, Environmental effects, Electric powerplants, Cooling water, Thermal powerplants, Operations, Operating costs, Reservoirs, Risks, Water use, Evaluation studies, Management planning, Economic effects.

Water is used for cooling in thermal power generation and as a source of power for hydropower generation. In the United States, 210 billion gallons of water per day (9,200 cu m/s) are withdrawn for cooling thermal power plants. This volume represents 47% of all water withdrawals nationally. An additional 3,300 billion gallons/day (145,000 cu m/s) pass through hydropower turbines. Without plentiful water, the annual production of 1,900,000 GWh of thermally generated energy, and the 310,000 GWh of hydropower energy production, would be impossible. During a year of average conditions, water for power production is abundant. However, during drought periods, normal power production can be affected significantly. These effects may be experienced as increases in the cost of power production, increases in the demand for energy, loss of power production capabilities, and adverse environmental impacts. Interviews with utility personnel indicate that as competition for reliable sources of water increases, the susceptibility of energy production to drought will also increase. Drought impacts over the last decade clearly suggest their economic significance, and their potential will increase in the future. Improved method of planning and operation during droughts are necessary to meet these challenges. Planning based solely on critical period analysis should be complemented with risk based approaches incorporating hydrologic uncertainties. The use of sensitivity analysis in risk studies can illustrate the importance of model assumptions, suggest data needs, and rank design alternatives. Such planning approaches will improve drought planning and help to minimize the costs of future droughts. The case study demonstrates, by comparing critical period analysis and risk analysis, that the selection procedure can have a significant impact on the alternative selected. (Lantz-PTT)
W87-03060

DECISION SUPPORT SYSTEM FOR LOCAL WATER MANAGEMENT,
Portland State Univ., OR. Dept. of Civil Engineering.
R. W. Koch, and R. L. Allen.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 4, p 527-541, October 1986. 4 fig, 11 ref, append.

Descriptors: *Decision making, *Water management, *Computers, *Irrigation, *Water demand, *Water use, Microcomputers, Simulation analysis, Soil water, River flow, Storage reservoirs, Data collections, Hydrologic models, River systems, Water conveyance.

Although technologically advanced methods have been used to manage large water resource systems, there is both a need and an opportunity for application of similar techniques at the level of the individual user. With a microcomputer as a computational tool, a decision support system (DSS) is developed for use by local water managers, where the appropriate water rights doctrine applies and irrigation is the primary water use. The DSS consists of data files describing the water rights, water use and hydrologic systems integrated with simulation models for soil moisture and river routing in response to irrigation diversions and inflows. The model allows projection of irrigation demands and assessment of the effects of distribution strategies on flow in the river system. Operation fo the DSS is demonstrated on a small hypothetical river system. Even though the hardware and software appear to be suitable to the task, actual application may depend on cooperation among users and be limited to providing advice on amount and timing of irrigation. (Author's abstract)
W87-03064

STRUCTURAL CHANGE IMPLICATIONS FOR INDUSTRIAL WATER USE,
Inland Waters Directorate, Ottawa (Ontario). Water Planning and Management Branch.
D. M. Tate.
Water Resources Research WRERAQ, Vol. 22, No. 11, p 1526-1530, October 1986. 5 tab, 14 ref.

Descriptors: *Industrial water, *Water use, *Model studies, Water supply, Water demand, Canada, Case studies, Mathematical analysis, Water use efficiency.

A framework is presented for incorporating structural change considerations into studies of industrial water use. A modified input-output model is used to qualify the effects on water use of structurally related factors, changes in supply and demand conditions, changes in productivity and technology, and changes in water use practices. A number of case studies were run using this framework for Canada in the period 1966-1976. Changes in supply and demand conditions, as measured by changes in final demand, were responsible for large positive increases in water use. Changes in productivity and technological factors, as measured by changes in the set of input-output inverse matrices used, were responsible for large negative changes in water use. Changes in water use practices, denoted by changing water use coefficients, were usually negative in their impacts on water use. The latter two factors combined to partially offset increases in water use due to the final demand factor. The major factor working toward reduced industrial water use, was related to changes in production technology, the ways in which inputs and outputs were combined, and not to changes in actual water use practices. (Author's abstract)
W87-03190

RESERVOIR REGULATION AND SELECTIVE WITHDRAWAL IN OREGON,
Army Engineer District, Portland, OR.
R. A. Cassidy.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 28-34, 1 fig, 9 ref.

Descriptors: *Reservoir operation, *Selective withdrawal, *Oregon, *Water demand, Rogue River, River basins, Lost Creek Lake, Applegate Lake, Water development, Temperature, Turbidity, Fisheries, Water use.

Selective withdrawal structures have fused the real world considerations of water quantity with the previously esoteric issues of water quality to form dynamic water resource issues in the State of Oregon. Selective withdrawal capability in the Portland District's two Rogue River Basin projects has not only increased the day-to-day reservoir regulation considerations for the Corps of Engineers, but has also made profound changes in the way state water resources agencies consider release changes. Regulation of Lost Creek and Applegate Lakes represents another level of water resource management for the Portland District because, in addition to managing conflicting multiple purpose water uses, water temperature and turbidity controls have added another complex dimension to project impact on fisheries. During the first few years following impoundment, the Portland District worked closely with the Oregon Department of Fish and Wildlife, varying water temperature and outflows to help determine the best combination for the fishery. Manipulation of releases from the two projects so inflamed the fisherman of the Rogue River Basin that the Portland District established a toll-free telephone service to inform fishermen of the latest regulation changes. Dissatisfaction ultimately led the governor to direct that state water resources related agencies could no longer contact the Corps of Engineers directly concerning requests for unscheduled regulation changes. Since 1983, all State agency requests to the Corps of Engineers for regulation changes must be coordinated through the Oregon Water Resources Department. (See also W87-03221) (Author's abstract)
W87-03226

6E. Water Law and Institutions

SMALL HYDROELECTRIC PLANTS AND ENVIRONEMENTAL PROTECTION, (PETITE HYDRAULIQUE ET PROTECTION DE L'ENVIRONMENT),
For primary bibliographic entry see Field 8C.
W87-02573

WATER SUPPLY IN THE NORTHEAST: A STUDY IN REGULATORY FAILURE,
Indiana Univ. at Bloomington. School of Law.
A. J. Gellis.
Ecology Law Quarterly, Vol. 12, No. 3, p 429-479, 1985. 307 ref.

Descriptors: *Regulations, *Regulatory failure, *Northeast United States, *Regional planning, *Water rights, Water, Drought, Water regulations, Regionalization, Local governments.

Although water is plentiful in the Northeastern United States, because of droughts and the fact that water sources are not always within the convenient reach of population centers, there have been man-made shortages. These man-made shortages occur because the states lack the institutional arrangements necessary to provide a sufficient supply of water to their residents in time of drought. Therefore, it is time for states to recognize that water supply can no longer be left to individual local governments. Reliance on voluntary mergers and contracting among systems has left the Northeast vulnerable to periodic water shortages. The solution is regionalization. A regional network for public water supply would have the legal and financial capability to insure adequate water supply during droughts. (David-PTT)
W87-02590

WILDLAND MANAGEMENT ON POINT PELEE, RONDEAU, AND LONG POINT PENINSULAS, LAKE ERIE,
Waterloo Univ. (Ontario).
For primary bibliographic entry see Field 6G.
W87-02591

IXTAPA DRAFT AGREEMENT RELATING TO THE USE OF TRANSBOUNDARY GROUNDWATERS,
New Mexico Univ., Albuquerque. Natural Resources Center.
A. B. Rodgers, and A. E. Utton.
Natural Resources Journal, Vol. 25, No. 3, p 713-772, July 1985. 121 ref.

Descriptors: *Groundwater allocation, *Ixtapa draft agreement, *Water law, *Water rights, *International law, International agreements, Regulations, Legal aspects, Aquifers, Ixtapa, Subsurface water, Water, Subterranean water.

In an attempt to respond to the questions regarding the development of transboundary law and institutions, a small, multi-disciplinary working group of water resources specialists has met over a period of three years to prepare a draft agreement for the allocation and management of transboundary groundwaters. The Working Group wrestled with the problems of allocation and regulation, and debated and exchanged views from the vantage point of different disciplines. They did not meet with the idea of dictating to governments, but rather worked to explore the kinds of problems which may be encountered in the sharing of transboundary aquifers, and in the process to make some suggestions on how to address allocation and regulation issues. By providing some threshold thinking which may stimulate others to explore the issues further, it is the hope of the Working Group to advance the understanding of the allocation and prudent use of transboundary groundwaters which is at a pioneering stage. In short, it is an attempt to address the problems before the crisis is upon us. (David-PTT)
W87-02592

AMOCO CADIZ AND LIMITATION OF LIABILITY FOR OIL SPILL POLLUTION: DOMESTIC AND INTERNATIONAL SOLUTIONS,
L. Rosenthal, and C. Raper.
Virginia Journal of Natural Resources Law, Vol. 5, No. 1, p 259-295, Fall 1985. 291 ref.

Descriptors: *Oil spill liability, *Oil spill, *Amoco Cadiz, *Liability, *International law, Legal aspects, Oil tankers, Insurance, Oil pollution, Pollution, United States District Court, Brittany Coast.

On March 16, 1978, the supertanker Amoco Cadiz ran aground off the French coast during a storm. The ship spilled crude oil over 130 miles of the Brittany coast, severely damaging beaches and fishing grounds. On April 18, 1984, the United States District Court held that Standard Oil Company and two of its subsidiaries were liable without limitation for the damage caused by the accident. Because of the Limitation of Liability Act of 1851, the shipowner was limited in liability. The United States should repeal the Limitation Act, at least with regard to oil pollution. Even if a court holds a shipowner or cargo owner liable, compensation to the victim often comes years after the injury. A better system would require immediate compensation of the oil pollution victims and provice insurers with a right to sue any parties who negligently, recklessly, or willfully caused the accident. (David-PTT)
W87-02593

FISHING FROM THE BANK: PUBLIC RECREATIONAL RIGHTS ALONG IDAHO'S RIVERS AND LAKES,
P. A. Parker.
Idaho Law Review, Vol. 21, No. 2, p 275-301, Spring 1985. 194 ref.

Descriptors: *Public rights, *Idaho, *Public access, *Water law, *Water rights, *Recreation, Outdoor recreation, Boating, Fishing, Camping, Swimming, Public waters, Legal aspects, Legislation.

Idaho is blessed with an abundance of waterways available for fishing, boating, and swimming. With 70 percent of Idaho's land in public domain, the public's recreational access and use of the state's water resources would seem to be a minor problem. However, the land surrounding many of these water resources, particularly those adjacent to major population areas, is in private hands. This has created a tension between an expanding public seeking full recreational use of the state's waterways and private landowners desirous of guarding their private property rights. The trend, though, seems to be towards expanding public usage. The Idaho Supreme Court's decision in one case gave recreational users the right to use waterways that met a minimum definition of navigability. (David-PTT)
W87-02594

COLORADO V. NEW MEXICO II: JUDICIAL RESTRAINT IN THE EQUITABLE APPORTIONMENT OF INTERSTATE WATERS,
P. A. Fahmy.
Denver Law Journal, Vol. 62, No. 3/4, p 857-872, 1985. 161 ref.

Descriptors: *Water law, *State jurisdiction, *Interstate water rights, *Colorado, *New Mexico, Equitable apportionment, Interstate waters, Judicial restraint, Streams, Lakes, Legal aspects.

In Colorado v. New Mexico, the United States Supreme Court clarified the evidentiary standard of review used pursuant to the doctrine of equitable apportionment in original jurisdiction actions involving the allocation of interstate waters. The court's decision in this case portends the end of interstate water rights litigation in the original jurisdiction of the Supreme Court. The Court has definitively outlined the onerousness of the claimant's burden of proof in equitable apportionment actions and only time will tell if any state is willing or able to shoulder such an evidentiary burden. Althought judicial restraint may often be laudable,

its value is questionable in instances of interstate water rights. When a state has been unsuccessful in reaching an accord with a contending state whose negotiating position is superior because of existing appropriations, there should exist a meaningful opportunity to obtain equitable relief through the original jurisdiction of the Supreme Court. (David-PTT)
W87-02595

ABSTENTION: THE CROOKED COURSE OF COLORADO RIVER,
Temple Univ., Philadelphia, PA. School of Law.
D. A. Sonenshein.
Tulane Law Review, Vol. 59, No. 3, p 651-699, January 1985. 230 ref.

Descriptors: *Colorado River Water Conservation District, *Water law, *Judicial decisions, *State jurisdiction, Legal aspects, Federal jurisdiction, Colorado River, Water, Water conservation.

In 1976 in Colorado River Water Conservation District v. United States, the Supreme Court placed its imprimatur on a federal court's abstention from hearing a case unquestionably within its jurisdiction because the same parties were concurrently litigating the same issues in a state court. Although seemingly limited by the case's rather unusual circumstances, the Court's decision was expanded by the lower courts, which in many cases abstained from hearing claims within their jurisdiction for little reason other than the mere filing of similar actions by one of the parties in a state court. Even though the Court, in a recent case, has severely limited the ability of federal courts to so abstain, there was little analysis of the policies and implications of this new form of abstention, including its effect on the exclusive jurisdiction of the federal courts. The history of the Colorado River abstention doctrine is traced, its shortcomings and benefits are analyzed, and ways to answer the questions that remain unanswered are proposed. (David-PTT)
W87-02596

EMERGING TRENDS IN INFRASTRUCTURE FINANCING,
Congressional Budget Office, Washington, DC. Natural Resources and Commerce Div.
For primary bibliographic entry see Field 6C.
W87-02606

EMERGENCE OF ENVIRONMENTAL LAW IN THE DEVELOPING COUNTRIES: A CASE STUDY OF INDIA,
Indian Society of International Law, New Delhi.
K. Ramakrishna.
Ecology Law Quarterly, Vol. 12, No. 4, p 907-935, 1985. 253 ref.

Descriptors: *Environmental law, *Developing countries, *India, *Environmental protection, Economic development, Protection, Environmental management, Environmental policy.

Environmental protection has been viewed by many developing nations, including India, as a ploy to divert such nations from achieving their own economic development. The late Indian Prime Minister Indira Gandhi expressed this attitude in 1972: about 'speaking' to those who live in villages and in slums about keeping the oceans, rivers and the air clean when their own lives are contaminated at the source. In 1983 Prime Minister Gandhi changed her postion: The preservation of the environment is an economic consideration since it is closely related to the depletion, restoration and increase of resources. In any policy decision and its implementation we must balance present gains with likely damage in the not too distant future... Today in India, the Indian government has tried to accommodate both the interests of environmental protection and economic development in its policies. A central government administrative framework is in place, and Parliment has enacted significant legislation in substantial areas of environmental law. A variety of problems, though, still remain. These include uncertainty about the legislative authority of the central government to implement environmental statutes, enforcement problems, lack of a private right of action, and insufficient resources to implement environmental laws. A concerted, unified effort by the Indian government is necessary to solve these problems and to assure the future integrity of India's environment. (David-PTT)
W87-02616

NATIONAL WATER POLICY -- DOES ANYBODY WANT ONE,
American Water Resources Association, Bethesda, MD.
D. C. Harrison.
Consulting Engineer, Vol. 65, No. 6, p 27-30, December 1985.

Descriptors: *National water policy, *Regional development, *Local governments, *Public policy, Water policy, Red River Valley, Regional planning, Institutions, Watershed level.

The institutional responses to water policy issues are complex and not well understood. While there is no argument concerning the desirability of a cohesive national water policy, the problem of how to achieve it is more complex and debatable. If the nation's water resource regions form the basic building blocks of the national interest, then the regional level is where the analysis must start. In some watersheds under stress, such as the Red River Valley of the North, local interests are attempting to develop policy procedures and institutions for asserting their collective interests. These are the only settings where the question can be put as to whether unified policy is needed--at the watershed level, collectively among the local governments and others whose interests are most immediately and directly affected. (David-PTT)
W87-02619

HISTORY OF THE FEDERAL-STATE COOPERATIVE WATER RESOURCES RESEARCH INSTITUTE PROGRAM,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 9D.
W87-02632

ANTIDEGRADATION POLICY FOR PRESERVING SURFACE WATER QUALITY IN FLORIDA,
Florida State Dept. of Environmental Regulation, Tallahassee.
For primary bibliographic entry see Field 5G.
W87-02636

LONG DISTQANCE WATER RIGHTS,
Black and Veatch, Kansas City, MO.
R. L. Smith, L. K. Lampe, and K. Anderberg.
The American City and County ACCOD3, Vol. 101, No. 3, p 40-42, March 1986.

Descriptors: *Water rights, *Water law, *Water demand, *Regional planning,Interbasin transfers, Legal aspects, Water distribution.

Water rights issues are examined in terms of changing demographic patterns and legal, socio-political and economic considerations. Factors influencing interstate and interbasin transfers are discussed in relation to competing industrial, municipal and recreational demands for water. (Michael-PTT)
W87-02637

VIRGINIA, NORTH CAROLINA WAGE WATER-RIGHTS BATTLE,
T. M. Leahy.
The American City and County ACCOD3, Vol. 101, No. 3, p 48-50, March 1986.

Descriptors: *Virginia, *North Carolina, *Water law, *Water rights, *Reservoirs, Interstate rivers, Legal aspects.

An interstate water rights dispute between Virginia and North Carolina has delayed the implementation of the Lake Gaston reservoir development project in Virginia Beach, Va. The city is proceeding with design of a pipeline although the legal questions are not yet decided. There is strong opposition to the project in North Carolina although several findings of no significant impacts have been issued. (Michael-PTT)
W87-02638

SNOW LOADS IN THE 1985 NATIONAL BUILDING CODE OF CANADA: CURVED ROOFS,
Alberta Univ., Edmonton. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2C.
W87-02667

COASTAL FLOOD INSURANCE,
For primary bibliographic entry see Field 6F.
W87-02782

MARYLAND'S PHOSPHATE BAN-HISTORY AND EARLY RESULTS,
Washington Suburban Sanitary Commission, Hyattsville, MD.
For primary bibliographic entry see Field 5G.
W87-02819

PUBLIC POLICY IMPLICATIONS OF TOXIC CHEMICALS IN DRINKING WATER: A CASE STUDY OF LONG ISLAND, NY,
New York Public Interest Research Group, Inc., NY.
For primary bibliographic entry see Field 5C.
W87-02826

DROUGHT POLICY IN THE U.S. AND AUSTRALIA: A COMPARATIVE ANALYSIS,
Nebraska Univ.-Lincoln. Center for Agricultural Meteorology and Climatology.
D. A. Wilhite.
Water Resources Bulletin WARBAQ, Vol. 22, No. 3, p 425-438, June 1986. 2 fig, 6 tab, 36 ref. NSF Grant ATM-8313356.

Descriptors: *Drought policy, *United States, *Public policy, *Australia, Drought, Drought response, Water policy, Water planning, Water law, Water shortage.

Some portions of the United States and Australia are frequently affected by drought which causes a substantial economic loss, especially to the agricultural sector. In the United States, drought relief is being provided primarily through loan, grant and conservation programs and through federal crop insurance. Much of Australia's agriculturally important area is located in marginal rainfall zones where even a minor drought episode has immediate economic repercussions. Hence, Australian agriculture has been forced to make significant adjustments to its precarious situation. The drought programs and policies of state and federal government in the United States and Australia are reviewed and evaluated, and recommendations for improving the drought response capability of government in the United States are offered. In the United States and Australia, most government actions have occured in an environment of crisis management, rather than as a result of clearly stated policy objectives. It is suggested that a national drought plan be developed to implement recommendations. States should also become more actively involved in drought assessment and response, but these actions must be coordinated with federal actions. (Khumbatta-PTT)
W87-02937

BASIN WATER MONITORING: HYDROLOGIC IMPACT OR LEGAL COMPLIANCE,
Frostburg State Coll., MD. Dept. of Geography.
D. W. Duckson.
Water Resources Bulletin WARBAQ, Vol. 22, No. 3, p 457-464, June 1986. 4 fig, 1 tab, 37 ref.

Descriptors: *Monitoring, *Model studies, *Maryland, Hydrology, Water law, Pollution, Environ-

mental protection, Groundwater, Surface water, Geohydrology, Permits, Regulations, Data acquisition.

The past inability to control environmental degradation from coal mining through common law often has resulted in legislative intervention. Several aspects of the permit requirements for hydrologic monitoring and impact assessment under the Surface Mining Control and Reclamation Act of 1977 (PL 95-87) are examined. The intent of the law is to have mining policies and practices be initiated only after an understanding has been reached with respect to potential environmental consequences and possible mitigations. The Act requires that data should be collected prior to mining which will allow a determination to be made of the probable hydrologic consequences. Modeling strategies exist which allow for such determination, but selection of a specific model form will dictate the length of data record needed. The absence of a sound management strategy by the regulatory authority in Maryland does not result in valid data collection and suggests that the Maryland Bureau of Mines is concerned more with legal compliance than with integrated source management. (Khumbatta-PTT)
W87-02940

VOTER REACTIONS TO THE 1976 WATER DEVELOPMENT AND QUALITY REFERENDA IN TEXAS,
University of Southern California, Los Angeles. Dept. of Geography.
F. M. Shelley, F. A. Schoolmaster, and R. S. Roberts.
Water Resources Bulletin WARBAQ, Vol. 22, No. 3, p 485-494, June 1986. 4 fig, 3 tab, 39 ref.

Descriptors: *Legal aspects, *Voter reactions, *Water resources development, *Water quality, *Texas, *Referenda, Water policy, Statistical analysis, Public opinion, Geography.

Since 1957, Texans have voted on eight referenda concerning the allocation of state funds for water resources development and the maintenance of water quality. In 1976, a water development amendment and a water quality amendment were presented simultaneously to the voters of Texas. The cartographic and statistical analyses of the county-level voting outcomes for each referendum, which were supported by voters in water deficient West Texas, especially those counties dependent on irrigated crop production are presented. Urban voters and East Texans tended to oppose both amendments. Support for the water quality amendment in the urbanized areas of Dallas-Fort Worth, Austin, and San Antonio enabled this amendement to pass statewide while its counterpart failed. The results highlight the importance of local differences in perceived water policy needs, and in doing so they illustrate that geopgraphical analysis of returns from initiatives and referenda is a useful tool for understanding the locational conflicts underlying water resources and other policy efforts. (Author's abstract)
W87-02944

SAFE DRINKING WATER ACT,
Camp, Dresser and McKee, Inc., Boston, MA.
J. C. Thompson.
Public Works PUWOAH, Vol. 117, No. 9, p 123-125, 184, 186, 188, September 1986. 10 tab.

Descriptors: *Safe Drinking Water Act, *Drinking water regulations, Organic compounds, Inorganic compounds, Contamination, Microorganisms, Radioactive wastes, Pollutants, Filtration, Disinfection, Environmental Protection Agency.

A summary of recent amendments to the Safe Drinking Water Act (SDWA) and proposed revisions to Federal drinking water regulations was presented. Regulated substances including volatile organic compounds, synthetic organic chemicals, inorganic chemicals and microbiological and radionuclide contaminants were listed and proposed recommended maximum contaminant levels for these substances were examined. Treatment and control techniques such as filtration and disinfection were also reviewed. The new SDWA amendments may encourage the Environmental Protection Agency to promulgate additional regulations on drinking water maximum contaminant levels in a more timely fashion. (Michael-PTT)
W87-03122

ESTABLISHING A STORMWATER MANAGEMENT UTILITY,
Cincinnati Dept. of Public Works, OH. Div. of Stormwater Management Utility.
For primary bibliographic entry see Field 2E.
W87-03123

RESERVOIR REGULATION AND SELECTIVE WITHDRAWAL IN OREGON,
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 6D.
W87-03226

LEGAL SYSTEM AND WORKS FOR PRESERVATION OF THE PORT, HARBOUR, AND MARINE ENVIRONMENT IN JAPAN,
Bureau of Ports and Harbors, Tokyo (Japan).
For primary bibliographic entry see Field 5G.
W87-03249

PROCEEDINGS OF THE OHIO WATER LAW CONFERENCE.
National Water Well Association, Worthington, OH.
Available from the National Water Well Association, 500 W. Wilson Bridge Road, Worthington, Ohio, 43085. December 6, 1983, Columbus, OH. 1983. 97 p.

Descriptors: *Water law, *Ohio, *Conferences, Groundwater, Water use, Water resources, Legal aspects, Legislation.

The Ohio Water Law Conference investigated the development of the law of the State of Ohio governing both groundwater and surface water geology, the Ohio common law rules pertaining to groundwater, and surface water use, regulatory issues involved in groundwater protection, current state water policy and proposed legislation addressing groundwater allocation. These proceedings are a compilation of papers presented by the conference speakers. (See also W87-03309 - W87-03315) (Author's abstract)
W87-03308

GROUNDWATER: ITS OCCURRENCE, MOVEMENT AND POTENTIAL FOR POLLUTION,
National Water Well Association, Worthington, OH.
For primary bibliographic entry see Field 2F.
W87-03309

OHIO WATER LAW: THE PRESENT,
J. R. Hanson.
IN: Proceedings of the Ohio Water Law Conference, December 6, 1983 Columbus, Ohio. 1983. p 13-17.

Descriptors: *Water law, *Ohio, Legal aspects, Groundwater, Irrigation, Water use, Water resources development.

Recommended are three publications for information on the status of water law. The water rights law in Ohio is 'riparian', which refers to being on the banks of a river. The person who owns the bank or the land that abuts the stream has no property in the water itself, but only a right to use it. He is required to return it to the stream unchanged. The Ohio law of surface rights can be found in its most basic presentation in Canton v. Shock, 66 OS 19 (1902). The dramatic aspect of this case is that the court said it is not just landowners, but municipal corporations which abut the stream which may provide water to their residents throughout the municipality. This rule gives municipal corporations an expandable dominion over surface streams which resembles absolute ownership. Water diversion rights, irrigation, groundwater law and water resources law, are all discussed through various cases decided in different levels of the Ohio court system. (See also W87-03308) (Lantz-PTT)
W87-03310

OHIO WATER LAW: ANALYSES OF PRESENT WATER PROTECTION STRATEGIES AND SUGGESTIONS FOR THE FUTURE,
Ohio State Univ., Columbus. Coll. of Law.
E. F. Murphy.
IN: Proceedings of the Ohio Water Law Conference, December 6, 1983 Columbus, Ohio. 1983. p 18-30.

Descriptors: *Water law, *Ohio, *Water rights, Groundwater, Legal aspects, Water resources, Flow, Water supply.

The public has four ways available for effectively asserting a superior right over riparians in flow water: (1) either by state or federal law, the public can regulate the use of the water by the riparian; (2) the public can acquire all riparian rights by purchase, or in an appropriation jurisdiction, by appropriation. The public, of course, can also condemn in any riparian right by the exercise of its power of eminent domain; (3) the public can assert the public trust doctrine under which private property rights could never develop against the public trust. What the consequences of that is for the riparian doctrine has not yet been explored; and (4) in appropriation jurisdictions, the State can reserve unappropriated water. Therefore, nobody is able to claim this water against the State's reservation. Groundwater, however, has different laws, the problems with which are: (1) that despite the fact that the English court in Acton v. Blundell, supra was clearly reasoning by an analogy to surface stream law, the groundwater law developed independently of the law of streams and the law of surface or runoff water; (2) indefiniteness of property rights. This means that no lawyer can tell a client just precisely what can be done with water without a high degree of risk for the client to some previously unknowable person for some previously impossible-to-determine amount in damages or interdiction in equity; (3) as long as water is plentiful in relation to demand for it, it is effectively a free good in the market and just about any rule of law can be tolerated; and (4) the characteristics of water, its seasonal flow, its slowness of movement in the ground, its specificity of location, delay perceptions of competition. (See also W87-03308) (Lantz-PTT)
W87-03311

STATE COMMON LAW WATER RIGHTS IN THE CONTEXT OF THE FEDERAL SYSTEM,
National Water Well Association, Worthington, OH.
J. X. Dinovo.
IN: Proceedings of the Ohio Water Law Conference, December 6, 1983 Columbus, Ohio. 1983. p 31-44, 2 append.

Descriptors: *Water law, *Ohio, *Water rights, Common law, Constitutional law, Water resources.

Water rights in the State of Ohio can be divided into two basic areas of the law. These areas concern the common law presently in existence, and the constitutional parameters limiting any future legislative attempts at defining water rights. Consideration of the state's common law is a necessary starting point for any discussion of water rights. The common law, in the absence of positive legislation, defines relations among private parties and often is the source of property rights which are a subject of constitutional protection. Constitutional law must be considered in that: (1) It places limitations on how government may affect private rights; and (2) It governs the relations among states and between the states and the federal government. As such, consideration of both of these areas of law is necessary in order that a proper understanding of water rights is obtained. (See also W87-03308) (Lantz-PTT)
W87-03312

OHIO WATER LAW: PRESENT ASPECTS OF OHIO WATER POLICY,
Ohio Dept. of Natural Resources, Columbus. Div. of Water.
R. L. Goettemoeller.
Proceedings of the Ohio Water Law Conference, December 6, 1983 Columbus, Ohio. 1983. p 51-62.

Descriptors: *Water law, *Ohio, Groundwater management, Management planning, Water resources development, Water supply, Legal aspects.

One of the major obstacles in the proper management and development of Ohio's water resources is adequate financing. The regional water plans indicate 130 of the nearly 700 public water systems have immediate deficiencies. They need to increase their supplies by some 670 million gallons/day, at a cost of about $300 million. By the year 2000 an additional 120 systems are projected to need added water supplies. An additional $375 million will be needed to accomplish this. Those estimated costs are based upon 1979 prices and obviously should be somewhat higher today. Obviously, increased water and sewer rates are required, but state and federal policies and programs should be developed and geared to support that action. Strongly needed is perhaps long-term low interest loans. About 40 counties and 80 municipalities have adopted local programs to deal with accelerating storm water problems and/or urban sedimentation problems, based on state guidelines. Ohio's groundwater resources have come into question recently because of a growing, nationwide concern over groundwater supply. House Bill 579 would treat Ohio's groundwater as though it is a big western water formation, declining in quantity. The bill would declare groundwater to be public and to be administered by the state, and create a five-member water commission to regulate water well drilling and uses of groundwater. The bill would also require the filing of well logs to be shifted from the Division of Water, Department of Natural Resources, to the Water Commission. Water well drillers will be subject to annual registration and bonding requirements. This appears to be in conflict with or perhaps is a duplication of regulations adopted by the Ohio Department of Health. Regulations of groundwater users would be through 10-year permits, issued by the Water Commission. The bill would also require every well owner to apply for an application and submit an application fee within 120 days after the bill is passed. As massive and comprehensive as the potential water problems are in Ohio, one agency can't be expected to deal with all of them. If the existing expertise in the current agencies, the Dept. of Health, EPA, DNR, and others, is coordinated under the leadership and guidance of the Governor's office, problems can be solved with proper funding. It is generally agreed water management programs now ongoing in those agencies need to be closely coordinated but that doesn't require a new agency. (See also W87-03308) (Lantz-PTT)
W87-03313

CURRENT STATE OF OHIO'S WATER LAW FROM A JUDICIAL AND ADMINISTRATIVE PERSPECTIVE: CASE STUDIES AND DISCUSSION,
Ohio Office of the Attorney General, Columbus. Environmental Law Section.
D. Muchnicki.
IN: Proceedings of the Ohio Water Law Conference, December 6, 1983 Columbus, Ohio. 1983. p 63-73.

Descriptors: *Water law, *Ohio, *Water quality control, Legislation, Water quality standards, Groundwater management, Groundwater pollution, Water resources development, Case studies.

Groundwater protection from a regulatory standpoint is discussed from the following three aspects: (1) the results of the past enforcement efforts as reflected in court decisions; (2) administrative proceedings and their effect on groundwater protection; and (3) some trends that should be looked into for environmental enforcement, particularly related to groundwater issues. With regard to the first topic, there are only two cases, one an unreported decision, and another, a recently reported decision from the Franklin County Court of Appeals, Ohio. The first case is: State of Ohio v Skinner. That case was handed down back in 1979. The second case is State of Ohio ex rel. Brown, v J. Texas Howard, a reported decision, decided in 1981. From the perspective of administrative proceedings, permits for new sources of groundwater contamination are discussed, especially with respect to landfills. Future trends in Ohio should reflect the areas of: (1) litigation in Superfund and/or hazardous waste cleanups; (2) how to measure damages for loss of groundwater; and (3) a determination for when an area can truely be called 'clean'. (See also W87-03308) (Lantz-PTT)
W87-03314

MOVING TOWARD A COORDINATED GROUNDWATER MANAGEMENT APPROACH - A LEGISLATIVE PROPOSAL,
Knepper, White, Arter and Hadden, Columbus, OH.
R. Fahey.
IN: Proceedings of the Ohio Water Law Conference, December 6, 1983 Columbus, Ohio. 1983. p 74-78.

Descriptors: *Water law, *Ohio, *Water management, Water quality control, Administrative regulations, Regulations, Groundwater management, Legal aspects, Legislation.

In the state of Ohio, there is public concern that groundwater will not be regulated until it is too late. The legislature is currently attempting to remedy this problem for Ohio with legislation that would set up a commission designed to be a tool for groundwater resources management. The legislation would also address the current fragmented regulation by coordinating activities between all involved parties, such as EPA, Natural Resources, Department of Health, etc. (See also W87-03308) (Lantz-PTT)
W87-03315

6F. Nonstructural Alternatives

ANTIDEGRADATION POLICY FOR PRESERVING SURFACE WATER QUALITY IN FLORIDA,
Florida State Dept. of Environmental Regulation, Tallahassee.
For primary bibliographic entry see Field 5G.
W87-02636

COASTAL FLOOD INSURANCE,
D. Lindley.
Oceans, Vol. 19, No. 3, p 30-33, 60, May-June 1986.

Descriptors: *Flood insurance, *Legal aspects, *Public policy, *Floods, Legislation, Economic aspects, Flood waves, Waves, Flood protection, Protection, Beaches.

The National Flood Insurance Program has had the effect of losing millions of dollars insuring lavish private homes along the shore, encouraging development of beaches. Private companies rarely offer such insurance, since a major torrent could bankrupt even the largest insurance company. Since the Federal Emergency Management Agency (FEMA) began administering flood insurance, building has boomed along the shore, while flood insurance losses have continued to increase. In the 10 years before government flood insurance, there were 186 deaths and $2.2 billion in damages due to hurricanes; in the 10 years after, there were 411 deaths and $4.7 billion worth of destruction. It is recommended that Congress stop any subsidies for new waterfront construction by stipulating a one-time-only payment in coastal flood zones, with payment contingent upon the property owner's agreement to vacate a building site that has proved to be unsuitable. (Doria-PTT)
W87-02782

RISK INFORMATION FOR FLOODPLAIN MANAGEMENT,
Utah Water Research Lab., Logan.
L. D. James, and B. Hall.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 4, p 485-499, October 1986. 4 fig, 27 ref.

Descriptors: *Flood plain management, *Information exchange, *Cost-benefit analysis, *Flood damage, Regulations, Incentives, Nonstructural alternatives, Public safety, Decision making, Floods, Flood protection, Flood benefits.

The United States began structural flood control in the 1930s and added complementary nonstructural measures in the 1960s. Nevertheless, national flood damage totals continue to increase. Reversal of this trend will require better communication among regulatory agencies, experts assessing risk, and floodplain occupants. Modern technology provides tools to measure specific risks and communicate the hazards of property loss and personal danger to individuals able to act to reduce the losses. One problem with the existing communication based on a safety standard tied to the 100-yr floodplain are only subject to trivial damage by shallow flooding, while other locations outside that magic boundary are subject to major devastation and threats of drowning by floods that could be as common as the true 25-yr event. Systematic estimation and dissemination of the risk of economic loss can reduce flood losses, vary community programs with the hazard to life and property, and help every floodplain occupant accommodate more effectively with his site-specific problem. (Author's abstract)
W87-03061

ALTERNATIVES FOR IMPROVING RESERVOIR WATER QUALITY,
Army Engineer District, Little Rock, AR.
For primary bibliographic entry see Field 5G.
W87-03228

MANAGEMENT OF BOTTOM SEDIMENTS CONTAINING TOXIC SUBSTANCES.
Army Engineer Inst. for Water Resources, Fort Belvoir, VA.
For primary bibliographic entry see Field 5G.
W87-03248

FLOODPLAIN MANAGEMENT HANDBOOK.
Flood Loss Reduction Associates, Palo Alto, CA.
Available from the U.S. Government Printing Office, Washington, DC. 20402. September 1981. 88 p, 29 ref, 3 append.

Descriptors: *Floodplain management, *Handbooks, Floods, Flood plains, Management planning, Flood protection, Structural engineering, Public policy, Public participation.

Floods are a persistent and serious problem throughout the United States. They are responsible annually for billions of dollars of losses and scores of deaths. Losses are growing rapidly and all parts of the nation are affected, including coastal, mountainous and desert regions. A concerted national effort is under way to stem the growth of flood losses. This handbook summarizes the problem and points out what can be done. It is intended to help local officials, public interest groups and concerned citizens in assessing the problems in their area and initiating appropriate and effective management of the floodplain. The handbook treats both riverine and coastal floodplains. It describes a full range structural and nonstructural measure to reduce flood losses and maintain the natural values of the floodplain. The handbook provides step-by-step guidance for developing a floodplain management program. It also identifies the range of technical and financial assistance available for preparing and implementing such programs. (Author's abstract)
W87-03330

6G. Ecologic Impact Of Water Development

WILDLAND MANAGEMENT ON POINT PELEE, RONDEAU, AND LONG POINT PENINSULAS, LAKE ERIE,
Waterloo Univ. (Ontario).
J. G. Nelson, and J. C. Day.
Environments, Vol. 17, No. 3, p 67-79, 1985. 5 fig, 50 ref.

Descriptors: *Wildland management, *Lake Erie, *Great Lakes, Point Pelee, Rondeau, Long Point, Conservation, Land development, Public policy, Management planning, Regional planning, Coastal zone management, Wildland conservation.

The study attempted (1) to compare and contrast the landscape and land use history of Point Pelee, Rondeau, and Long Point Peninsulas; (2) in the process to evaluate guiding concepts such as natural or preservation; and (3) to make a case for more research, intergovernmental coordination and public participation in developing and conserving the north Lake Erie coast. The three peninsulas manifest a need for more effective planning and management of Lake Erie and other Great Lakes coasts. Institutional arrangements are required that focus on the coastal zone and its highly dynamic biophysical and land use character. Existing arrangements do not sufficiently provide for coordinated management of land and water systems, nor do they recognize that separately applied federal, provincial, and regional land and water management policies and practices do not adequately deal with the dynamic land-water interface. (David-PTT)
W87-02591

ENVIRONMENTAL DESIGNS FOR STREAMBANK PROTECTION PROJECTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Effects Lab.
J. E. Henderson.
Water Resources Bulletin WARBAQ, Vol. 22, No. 4, p 549-558, August 1986. 6 fig, 44 ref.

Descriptors: *Stream banks, *Design criteria, *Environmental protection, *Bank protection, Habitats, Channel flow, Stream stabilization, Stream improvement, Deflection, Flood plain management.

The designs and practices of streambank protection projects in terms of protecting environmental values are presented. Environmental impacts of these projects include changes to terrestrial and aquatic habitats. The potential environmental benefits of designs based on channel flow characteristics and streambed stabilization are examined and techniques for management and preservation of floodplains, berms and riparian zones are discussed. Designs for deflection of erosive flows and the use of vegetation for bank protection are discussed. Construction and maintenance practices and cost issues are also examined. (Michael-PTT)
W87-02621

ECOLOGY AND ESTUARINE IMPACT ASSESSMENT: LESSONS LEARNED FROM THE HUDSON RIVER (U.S.A.) AND OTHER ESTUARINE EXPERIENCES,
Cornell Univ., Ithaca, NY. Ecosystems Research Center.
For primary bibliographic entry see Field 2L.
W87-02776

ENVIRONMENTAL IMPACT OF OIL SPILLS AND THE OIL INDUSTRY RESPONSE,
Texaco, Inc., Beacon, NY.
For primary bibliographic entry see Field 5C.
W87-02829

TRAVEL COST MODEL FOR LAKE RECREATION: A COMPARISON OF TWO METHODS FOR INCORPORATING SITE QUALITY AND SUBSTITUTION EFFECTS,
Environmental Protection Agency, Washington, DC. Economic Analysis Div.
For primary bibliographic entry see Field 6D.
W87-02872

DROUGHT POLICY IN THE U.S. AND AUSTRALIA: A COMPARATIVE ANALYSIS,
Nebraska Univ.-Lincoln. Center for Agricultural Meteorology and Climatology.
For primary bibliographic entry see Field 6E.
W87-02937

MODELLING OF INDUSTRIAL ECOLOGICAL SYSTEMS FOR EVALUATION OF HEALTH SERVICES,
University of Occupational and Environmental Health, Kitakyushu (Japan). School of Medicine.
For primary bibliographic entry see Field 4C.
W87-02979

COMPLEXITY IN COLUMBIA RIVER SYSTEMS MODELING,
Washington Univ., Seattle. Dept. of Civil Engineering.
For primary bibliographic entry see Field 6B.
W87-03059

GENERAL IMPACT OF ASWAN HIGH DAM,
Ohio State Univ., Columbus. Dept. of Civil Engineering.
S. E. Smith.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 4, p 551-562, October 1986. 1 fig, 15 ref.

Descriptors: *Environmental effects, *Aswan High Dam, *Water resources development, *Egypt, Nile River, Sedimentation, Scour, Reservoirs, Soil fertility, Coastal plains, Erosion, Water storage, Irrigation, Saline soils.

The Aswan High Dam in Egypt has been the focus of considerable attention with respect to its impact on the environment. Prior to its completion in 1971, critics voiced concern about the potential problems of sedimentation in the reservoir, downstream scour, riverbed degradation and coastal erosion, proliferation of disease vectors, and decreased soil fertility in the Egyptian Delta. Evidence supports the conclusion that rather than produce an ecological disaster, the Aswan High Dam has provided Egypt with a number of benefits that far outweigh the deletious impacts. The benefits may be summarized as follows: (1) Over-year storage of Nile, water which serves as the sole source of freshwater in Egypt; (2) timely release of water, permitting perennial irrigation; (3) flood protection; and (4) hydroelectric power production meeting almost half of the national requirement. On the negative side, the following problems may be included: (1) Loss of soil fertility due to salinization caused by excessive irrigation water; (2) coastal and riverine erosion; (3) undermining of ancient monuments due to reservoir-induced seismicity and high water table level; and (4) lowering of water quality due to increased river traffic induced by the flow regime provided by the High Dam. (Lantz-PTT)
W87-03066

CHANGES IN CATCHMENT RUNOFF FOLLOWING DRAINAGE AND AFFORESTATION,
Institute of Hydrology, Wallingford (England).
For primary bibliographic entry see Field 4C.
W87-03072

STEMMING THE LOSS OF COASTAL WETLAND HABITATS: JAMAICA AS A MODEL FOR TROPICAL DEVELOPING COUNTRIES,
Florida International Univ., Miami. Dept. of Biological Sciences.
For primary bibliographic entry see Field 2L.
W87-03128

HYDRAULIC DESIGN OF THE SELECTIVE WITHDRAWAL STRUCTURES AT THE ELK CREEK DAM,
Army Engineer District, Portland, OR.
For primary bibliographic entry see Field 8A.
W87-03225

OPERATION OF SELECTIVE WITHDRAWAL FACILITIES: LIBBY DAM, MONTANA,
Corps of Engineers, Seattle, WA. Seattle District.
For primary bibliographic entry see Field 5C.
W87-03227

DISSOLVED LOADS OF RIVERS AND SURFACE WATER QUANTITY/QUALITY RELATIONSHIPS.
International Association of Hydrological Sciences.
For primary bibliographic entry see Field 5B.
W87-03272

BUDGET OF WATER AND ITS CONSTITUENTS FOR LAKE TAUPO (NEW ZEALAND),
Utrecht Rijksuniversiteit (Netherlands). Dept. of Geography.
For primary bibliographic entry see Field 2H.
W87-03295

EFFECTS OF HYDRAULIC PROJECTS AND THEIR MANAGEMENT ON WATER QUALITY,
Electricite de France, Chatou. Direction des Etudes et Recherches.
R. Gras, J. P. Albignat, and Ph. Gosse.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 313-332, 10 fig, 1 tab, 10 ref.

Descriptors: *Hydraulic structures, *Water quality, *Management planning, *Environmental effects, Canals, Electric powerplants, Reservoirs, Pumped storage, Chemical analysis, Ecological effects.

Various types of hydraulic projects are reviewed in order to examine the extent to which altering flow characteristics or other associated quantitative factors can effect water quality and more generally aquatic life. Particular attention is paid to the canalization of streams or rivers and to the construction of dams for navigation or electricity generation. A section covers reservoirs and pump storage stations and discusses their impact in the light of their characteristics and management. Some information is also given regarding estuarine or maritime projects, such as tidal power plants. The main water quality parameters are considered with special attention to thermal behavior. Physico-chemical parameters are considered as well as those concerning aquatic flora and fauna (plankton and fish resources). Specific examples are examined for most of these types of project. All hydraulic projects, including those to meet quantitative needs (navigation, irrigation, flood control) have a definite effect on the quality of water. Appropriate design or good management of a facility can limit a particular effect on the water quality, although it is necessary to have criteria to follow. The criteria relating to water quality differ from one use to another, and even for the same application, various criteria may be in conflict. Mathematical models allow these problems to be analyzed with respect to the estimation of effects, or to the improvement of the design and selection of proper management. Most of the time, however, the scope for adapting management in order to meet water quality criteria is limited. (See also W87-03272) (Lantz-PTT)
W87-03297

NUMERICAL SIMULATION RELATING LAND USES WITHIN A DRAINAGE BASIN TO THE DOWNSTREAM RIVER WATER QUALITY (SIMULATION NUMERIQUE DE L'INFLUENCE DES PRATIQUES CULTURALES DANS UN BASIN VERSANT SUR LA QUALITE DES EAUX A SON EXUTOIRE),

Centre National de la Recherche Scientifique, Toulouse (France). Inst. de Mecanique des Fluides.
B. Caussade, and M. Prat.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 359-369, 9 fig, 4 ref.

Descriptors: *Simulation analysis, *Mathematical studies, *Catchment areas, *Water quality, Rivers, Land use, Mathematical models, Hydrological models, Nitrogen, France, Leaching, Temperature.

In order to study the impact of land uses within a drainage basin on downstream river water quality, the authors propose a numerical model which is based on a conceptual hydrological model and simulates nitrogen transformations and transfers for polycrop basins, and non-point source exports. After calibration and validation using experimental data from a small basin in southwest France, the model is used to show the influence of various phenomena on water quality, including leaching, temperature, fertilizer use and crop type. (See also W87-03272) (Author's abstract)
W87-03300

ENVIRONMENTAL EFFECTS OF DIKES AND REVETMENTS ON LARGE RIVERINE SYSTEMS,
Iowa Cooperative Wildlife Research Unit, Ames.
M. B. Sandheinrich, and G. J. Atchison.
Available from the National Technical Information Service, Springfield, VA. 22161 as AD-A171000, A04 in paper copy, A01 in microfiche. Technical Report E-86-5, June 1986, Final Report. 51 p, 4 fig, 78 ref, append.

Descriptors: *Dikes, *Environmental effects, *River systems, Channels, Flow velocity, Stable channels, Fish, Mississippi River, Sedimentation, Water quality, Ecological effects, Aquatic habitats, Missouri River, Silt.

Dike fields are intermediate physically, chemically, and biologically to the main channel and backwaters of rivers. Dike fields often support the most diverse fish and macroinvertebrate community of any habitat within the river. But community composition is less stable than backwaters and is dependent upon river stage and water velocity. Moderate and slow-water areas within dike fields provide important spawning and nursery areas for many lotic species of fish within the modified river. Revetments of broken rock stabilize banks and provide additional hard substrate for colonization by dense populations of invertebrates. Interstitial spaces between rocks may provide areas of moderate flow for juvenile and forage fish. Long-term effects of river training structures may be detrimental to the biotic integrity of the river. Increased water velocity in the thalweg, as a result of the current being forced into the middle of the channel by dikes, result in riverbed degradation and dewatering of backwater areas during low flow. Stabilization of the channel prevents the river from meandering and forming new oxbow lakes, secondary channels, and backwater habitats. Deposition of silt in backwaters and on the downstream side of dikes results in the loss of these habitats in extreme cases. The result, as demonstrated in portions of the Missouri River, is a reduction in water-surface area; loss of island, chutes, and backwater areas; and the constriction of the river to a single, narrow channel. On the Lower Missisippi River, these effects have not yet been defined. (Lantz-PTT)
W87-03321

RESEARCH DESIGN FOR TUCSON AQUEDUCT, PHASE B DATA RECOVERY,
Arizona State Museum, Tucson. Cultural Resource Management Div.
J. S. Czaplicki, J. C. Ravesloot, and L. S. Teague.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB86-197563, A05 in paper copy, A01 in microfiche. Report No. DI-BR-APO-CCRS-86-3, January 1986. 78 p, 21 fig, 5 tab, 113 ref. Contract No. 6-CS-30-3500.

Descriptors: *Tucson, *Aqueducts, *Data acquisition, *Social impacts, Arizona, Archaeology, Pichacho Reservoir, Reservoirs.

Geographically, the Tucson Basin is defined as the segment of the middle Santa Cruz River bounded on the south by the community of Continental and on the north by the Tortolita and Catalina mountains. The western boundary of the Basin is formed by the Tucson and Sierrita mountains, while the Tanque Verde, Rincon, and Santa Rita ranges flank the Basin's eastern edge. The Tucson Aqueduct Phase B (TAP B) alignment is the last leg of the Central Arizona Project (CAP) canal system which will carry Colorado River water to central and southern Arizona. The Tucson Aqueduct portion of the CAP, which begins near Picacho Reservoir about 85 km north of Tucson, will bring water to the Tucson area for municipal, commercial, and agricultural purposes. Phase B is the second half of the Tucson Aqueduct, which begins near Marana and terminates at the southeastern corner of San Xavier Indian Reservation. An intensive archaeological survey of the Phase B alignment was conducted by archaeologists from the Cultural Resource Management Division (CRMD) of the Arizona State Museum (ASM) during 1983 and 1984. The survey covered 3370 ha and resulted in the identification of 47 sites: 3 Archaic campsites; 8 Hohokam settlements; 28 limited-activity sites, many of which are attributed to the Hohokam; 4 quarry sites; 3 protohistoric sites, and 1 historic site. (Lantz-PTT)
W87-03328

SUPPLEMENTAL CLASS III ARCHAEOLOGICAL SURVEY OF THE PHASE A, REACH 3 CORRIDOR, TUCSON AQUEDUCT, CENTRAL ARIZONA PROJECT: LATE SEDENTARY AND EARLY CLASSIC PERIOD TUCSON BASIN HOHOKAM OCCUPATION IN THE LOWER SANTA CRUZ BASIN, MARANA TO RILLITO, ARIZONA,
Arizona State Museum, Tucson. Cultural Resource Management Div.
J. S. Czaplicki, and A. G. Rankin.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB86-148202, A06 in paper copy, A01 in microfiche. Report No. DI-BR-APO-CCRS 85-15, June 1984. Supplmental to Archaeological Series 165. 97 p, 45 fig, 14 tab, 38 ref. Bureau of Reclamation Contract No. 0-07-30-X0091.

Descriptors: *Archaeology, *Tucson, *Aqueducts, *Social impact, Arizona, Santa Cruz River, River basins.

Approximately 600 acres of additional right-of-way in the Reach 3 Corridor, Tucson Aqueduct, were surveyed in late 1983 and early 1984. Fourteen new sites were identified, of which nine received ASM site numbers. The remaining five sites were not given an ASM site number, but merit reevaluation for assignment of a site number. This supplemental survey has altered considerably an earlier view of prehistoric occupation in Reach 3 that resulted from the original 1982 survey of the reach. Reach 3 now appears to pass through a habitation zone associated with the Nelson's Ranch platform mound site and also with many large agricultural field sites that cover the bajada slopes east of the right-of-way. The primary occupation of Reach 3 appears to belong to the Tanque Verde phase of the early Classic Period of the Tucson Basin Hohokam. However, there is evidence for occupation dating from the late Colonial Period up to the early Classic Period. (Author's abstract)
W87-03329

7. RESOURCES DATA

7A. Network Design

RATIONAL ALLOCATION OF MONITORING STATIONS IN A LAKE BY MEANS OF THE SPLINE TECHNIQUE,
Kyoto Univ. (Japan). Dept. of Environmental and Sanitary Engineering.
S. Fujii, I. Somiya, and H. Tsuno.
Ecological Modelling, Vol. 32, No. 1-3, p 43-57, June 1986. 10 fig, 1 tab, 2 ref.

Descriptors: *Monitoring, *Spline technique, *Water pollution sources, *Path of pollutants, *Interpolation, *Experimental design, *Water pollution, Lake Biwa, Japan, Field tests, Sampling, Lakes.

The spline technique, a kind of interpolation, is introduced as a method to estimate the horizontal distribution of water pollutant concentrations in a lake with some discrete data. A procedure to determine the rational allocation of monitoring stations in a lake is discussed on the basis of evaluating the influence of each point on the distribution pattern of pollutants. The data used for analysis were gathered at 22 survey stations in the southern basin of Lake Biwa (Japan) from April 1976 to February 1981. Though the magnitude of influence of each point varies according to the water quality index, there are obvious differences of magnitudes among sampling points, and the data of some special points can determine the rough shape of the surface. If about 10 of 22 sampling points that have a very big influence on the distribution pattern are selected properly, good estimation of the horizontal distribution of water quality can be obtained without significantly reducing the information on residual points. (Rochester-PTT)
W87-02598

COMPUTERIZED LAYOUT GENERATION FOR SANITARY SEWERS,
Yarmouk Univ., Irbid (Jordan). Dept. of Civil Engineering.
For primary bibliographic entry see Field 8A.
W87-03062

LOCATION OF AN INTERFACE OBSERVATION WELL: A BAYESIAN APPROACH,
Ministry of Agriculture, Jerusalem (Israel). Hydrological Service.
For primary bibliographic entry see Field 2F.
W87-03187

PRINCIPLES UNDERLYING THE DEVELOPMENT OF WATER QUALITY MONITORING SYSTEMS IN HUNGARY,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
G. Kovacs, and G. Pinter.
IN: Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships, Proceedings of a Symposium Held During the XVIII General Assembly of the International Union of Geodesy and Geophysics at Hamburg, West Germany, August 15-27, 1983. IAHS Publication 141, 1983. p 387-394, 5 fig, 11 ref.

Descriptors: *Water quality control, *Monitoring, *Hungary, Network design, Research priorities, Data acquisition, Data interpretation, Water sampling, Floods, Surface runoff.

The evolution and development of observation networks on the volume and quality of water resources in Hungary, and the establishment and modernization of the national water quality monitoring network, are discussed. Research and development has been aimed at evaluating and improving the information content of the data base including correlation of observation parameters (characteristics), potential completion of records, trend analysis of quality changes, effect of sampling frequency, impacts of surface runoff and flood waves on water quality. Application of scientific results in order to improve methods of acquisition and evaluation of water quality data has been undertaken. The principles and methods of the evaluation and classification system for water quality have been summarized in the Code of Practice, which was introduced in 1983. A number of scientific results, including the method of trend analysis have been incorporated in this code. (See also W87-03272) (Lantz-PTT)
W87-03303

7B. Data Acquisition

ION-EXCHANGE RESIN SAMPLERS FOR THE IN-SITE MEASUREMENT OF MAJOR CATIONS IN SOILWATER SOLUTE FLUX,
Birmingham Univ. (England). Dept. of Civil Engineering.
R. W. Crabtree, and M. J. Kirkby.
Journal of Hydrology JHYDA7, Vol. 80, No. 3/4, p 325-335, October 1985. 2 fig, 3 tab, 8 ref. NERC (England) Postdoctoral Fellowship GR3/4041.

Descriptors: *Soil water, *Solute transport, *Resins, Ion exchange, Field tests, Cations, Calcium, Magnesium, Potassium, Sodium, Duolite C26 resin.

A novel solute-flux measuring technique has been developed and a limited but successful field study was carried out for measuring the exchange and regeneration of major cations (Ca(2+), Mg(2+), K(+) and Na(+)) in soil water. Perspex columns containing ion-exchanges resins were placed into the soil to abstract the solute flux from soilwater flowing through the column. Column construction and emplacement procedures have been developed to minimize soilwater flow disturbance in and around soil-emplaced columns. (Kane-PTT)
W87-02678

INNOVATIVE TECHNIQUE FOR DETERMINING VELOCITY GRADIENT IN COAGULATION--FLOCCULATION PROCESS,
National Environmental Engineering Research Inst., Nagpur (India). Water Engineering Div.
For primary bibliographic entry see Field 5F.
W87-02708

SOIL-WATER DETERMINATION USING FIBER OPTICS,
North Dakota State Univ., Fargo.
For primary bibliographic entry see Field 2G.
W87-02723

REAL-TIME KINEMATIC CATCHMENT MODEL FOR HYDRO OPERATION,
University of the Witwatersrand, Johannesburg (South Africa). Water Systems Research Programme.
For primary bibliographic entry see Field 2E.
W87-02766

MEASUREMENTS OF PH VERSUS DROP SIZE IN NATURAL RAIN,
Auckland Univ. (New Zealand). Dept. of Physics.
For primary bibliographic entry see Field 2B.
W87-02811

$5.00, 1-MINUTE EFFLUENT QUALITY TESTER,
Salina Area Vocational-Technical School, KS.
T. Hobson.
Operations Forum, Vol. 3, No. 8, p 18-24, August 1986. 7 fig.

Descriptors: *Process control, *Activated sludge process, *Effluents, *Measuring instruments, *Water quality management, *Wastewater treatment, *Monitoring, Secchi disks, Activated sludge, Sludge, Clarifiers, Clarification, Spectrophotometry, Photometry, Wastewater facilities, Turbidity, Physical properties.

Quick, reliable, and inexpensive methods are presented for measuring effluent quality. Clarity can be measured with a Secchi disk; if measured clarity is less than 1.5 feet, then the plant effluent total suspended solids (TSS) concentration is probably at least 30 mg/l. Turbidity is measured using a spectrophotometer or by nephelometry; two measurements are recommended, the first on a mixed effluent sample, and the second on a sample that has been allowed to settle for one hour. The depth of the sludge blanket in the secondary clarifier can be measured by several methods, some using permanently installed instruments, and others used manually by the operator to sample or measure the sludge blanket. A number of these are described, and suppliers are listed. (Doria-PTT)
W87-02814

AQUIFER TRANSMISSIVITY OF POROUS MEDIA FROM RESISTIVITY DATA,
Roorkee Univ. (India). Dept. of Earth Sciences.
S. Niwas, and D. C. Singhal.
Journal of Hydrology JHYDA7, Vol. 82, No. 1/2, p 143-153, November 30, 1985. 2 fig, 4 tab, 26 ref.

Descriptors: *Geophysics, *Electrical studies, *Hydraulic conductivity, *Aquifers, *Transmissivity, *Porousmedia, *Resistivity, *Hydrology, *Mathematical studies, *Estimating, Permeability coefficient, Drilling, Pump testing, Groundwater, Alluvial aquifers, Glacial aquifers, Rhode Island, India.

An analytical relationship was developed between modified transverse resistance and aquifer transmissivity for estimating transmissivity from resistivity sounding data. The relation takes into consideration the variation in the quality of groundwater, and has been tested successfully on the glacial aquifers of Rhode Island and alluvial aquifers of three different areas of India. The practical applicability of the relation lies in the fact that if hydraulic conductivity is known for any reference point of a porous homogeneous aquifer, one can get a fairly good idea of the transmissivity of the aquifer at other locations within a basin from surface geo-electrical measurements. The relation will help optimize the information/cost ratio and avoid the indiscriminate and excessive use of drilling and pump testing to calculate aquifer transmissivity. (Author's abstract)
W87-02837

NEW ANALOGUE COMPUTER FOR THE STUDY OF PUMPING TESTS UNDER FALLING WATER-TABLE CONDITIONS,
British Geological Survey, Wallingford (England).
R. Herbert, and R. Croxford.
Journal of Hydrology JHYDA7, Vol. 83, No. 1/2, p 91-108, January 15, 1986. 10 fig, 11 ref.

Descriptors: *Analog computers, *Pumping tests, *Water table decline, *Simulation analysis, Computers, Water table, Pump wells, Wells, Aquifers, Compressibility, Drawdown, Water level, Prediction, Observation wells.

A new electrical analogue can simulate the continuous fall of the water table around a pumping well. Solid state switching devices follow the fall of the water table and well water level cutting out that area of the resistor mesh above the saturated zone. Pumping tests are simulated, showing how early-time behavior can be affected significantly by well storage and aquifer compressibility in unconfined aquifers. Predicted drawdowns are significantly different from those predicted using most commonly used theoretical methods. These simulations also confirm significant vertical head gradients during the early phases of a test. Such complexities can now be studied in detail without fear of truncation errors caused by discretisation of time as is necessary in digital models. The new analogue, by physically changing mesh resistor and capacitor values, can also simulate layered aquifers and wells having thick gravel packs and complex well screen geometries. Analogue simulations of pumping tests are also significantly cheaper than equivalent runs using digital modelling techniques. Work is underway to broaden the analogues' use to the study of recovery as well as drawdown. (Author's abstract)
W87-02854

REVIEW AND ANALYSIS OF METHODS FOR QUANTIFYING INSTREAM FLOW REQUIREMENTS,
Alaska Dept. of Fish and Game, Anchorage.
For primary bibliographic entry see Field 6D.
W87-02933

TECHNIQUES FOR WATER-USE MEASUREMENTS OF CROP PLANTS,
Kansas Agricultural Experiment Station, Manhattan. Evapotranspiration Lab.
M. B. Kirkham.
Hortscience, Vol. 20, No. 6, p 993-1001, December 1985. 1 tab, 172 ref.

Descriptors: *Measuring instruments, *Evapotranspiration, *Water use, *Crop plants, Plant water potential, Hygrometry, Osmosis, Pressure chambers, Turgor potential, Thermocouples, Stomata, Conductance, Transpiration, Pore pressure, Thermometers.

Instruments and methods for measuring crop plant water use are described in terms of their relative advantages and disvantages as reported in previous reviews of instrumentation for plant water studies. Instruments that measure plant water potential include thermocouple hygrometers, pressure chambers and the hydraulic press. Methods for measuring osmotic potential include measurement of solute concentration in frozen plant cells with a hygrometer or osmometer and use of a pressure chamber to to generate a pressure volume curve or a water release curve. Turgor potential determination methods include turgor potential calculations based on water and osmotic potentials derived from thermocouple hygometer measurements or direct measurement of turgor potential through pressure probes. Five methods for measuring stomatal conductance include microscopal observation, use of cobalt-chloride paper, determination of conductance from leaf chamber transpiration and mass flow and diffusion porometry. The use of infrared themometers to measure canopy temperature is also discussed. (Michael-PTT)
W87-02949

TECHNIQUES FOR MEASURING PLANT WATER,
Illinois Univ. at Urbana-Champaign. Dept. of Horticulture.
L. A. Spomer.
Hortscience, Vol. 20, No. 6, p 1021-1028, December 1985. 191 ref. Illinois Agricultural Experiment Station Project 65-353.

Descriptors: *Measuring instruments, *Plant water potential, Plant tissues, Water use, Sample preparation, Water vapor, Pressure chambers, Thermocouples.

Techniques for measuring plant tissue water content and tissue water requirements are described. Methods for direct and indirect measurement of tissue water content are evaluated in terms of sample preparation problems and possibility of measurement error. The concept of plant tissue water potential is defined and liquid and vapor phase and pressure chamber measurement techniques are evaluated. It is concluded that no single measure of plant water completely characterizes water status. Plant tissue water potential may be the best overall measure of water status, and the thermocouple psychromter may be the most precise means for measuring this plant water characteristic. (Michael-PTT)
W87-02950

REMOTE SENSING TECHNIQUES FOR ASSESSING WATER DEFICITS AND MODELING CROP RESPONSE,
Kansas Agricultural Experiment Station, Manhattan. Evapotranspiration Lab.
E. T. Kanemasu, G. Asrar, and M. Yoshida.
Hortscience, Vol. 20, No. 6, p 1043-1046, December 1985. 4 fig, 5 tab, 11 ref.

Descriptors: *Remote sensing, *Canopy parameters, *Water deficit, *Model studies, Temperature effects, Reflectance, Leaves, Crop yield, Simulation analysis, Soil water.

Water availability and temperature are 2 primary environmental parameters that frequently limit plant growth. The effects of these factors are difficult to separate. Plant responses to water deficit have been difficult to model because times involved and the problem of quantifying water deficit (severity vs. duration). Two experiments were conducted to assess the potential benefits of using

remotely sensed data to measure crop response to soil water deficits. Canopy temperature was determined to be an effective means of assessing critical soil water deficits. Canopy reflectance is also useful in estimating canopy parameters such as leaf area index. Critical levels of soil water deficit and leaf area index play key roles in crop growth and yield simulation models. (Michael-PTT)
W87-02953

USE OF PORTABLE RAINOUT SHELTERS TO INDUCE WATER STRESS,
Nebraska Univ.-Lincoln. Dept. of Agronomy.
For primary bibliographic entry see Field 2I.
W87-02991

CORDLESS GEO-DATA LINK,
Watermeyer, Legge, Piesold and Uhlmann, Ashford (England).
D. L. E. Teal.
International Water Power and Dam Construction IWPCDM, Vol. 38, No. 9, p 13-15, September 1986. 4 fig, 5 ref.

Descriptors: *Data transmission, *Sensors, *Earthworks, *Foundations, *Construction methods, Geophysical resistivity surveys, Data logger, Dams.

A cordless digital data transmission technique was developed to avoid problems associated with conventional umbilical data links employed to transmit data from within earthworks and foundations. Problems with conventional systems include disruption of earthwork construction and vulnerability of tubes or cables to damage. Normal radio-based systems are unsuitable for underground operation because of the high power needed to overcome signal attenuation. The present system transmits data on an electrical field of alternating polarity, which is analogous to that used in geophysical resistivity surveys. The entire transmitter with electrodes and sensors is buried in the earthworks, whereas the monitoring station and data logger are at the surface. (Author's abstract)
W87-03031

BOREHOLE TELEVISION FOR GEOTECHNICAL INVESTIGATIONS,
Westinghouse Electric Corp., Horseheads, NY. Industry and Government Tube Div.
R. Beyer, and A. M. Jacobs.
International Water Power and Dam Construction IWPCDM, Vol. 38, No. 9, p 16-18, September 1986.

Descriptors: *Dam safety, *Boreholes, *Television, *Tunnels, Caverns, Underwater.

A miniature borehole television system suitable for dam safety investigations is described, including critical design parameters, choice of the camera tube, viewing attachments, and mode of operation and applications. The miniature underwater television camera has found many geotechnical applications, including the inspection of boreholes for subsidence control and dam safety inspections. Design of illuminated viewing attachments widened the range of applications by permitting adaptation of the camera to three major requirements: down-hole viewing; close, side-hole viewing; and viewing of large voids, caverns, and tunnels. (Rochester-PTT)
W87-03032

DATA PROCESSING FOR HYDRO PLANT CONTROL,
Ateliers de Constructions Electriques de Charleroi (Belgium).
For primary bibliographic entry see Field 8C.
W87-03033

IMPROVED MONITORING OF AIR IN WATER,
Southampton Univ. (England). Dept. of Mechanical Engineering.
W. A. Mohammad, and S. P. Hutton.
International Water Power and Dam Construction IWPCDM, Vol. 38, No. 9, p 48-52, September 1986. 5 tab, 6 ref.

Descriptors: *Air entrainment, *Dissolved air, *Dissolved oxygen, Southampton Brand apparatus, Van Slyke apparatus, Mechanical engineering research laboratory apparatus, Water analysis, Air content.

The Southampton Brand apparatus is described and the results of tests for determination of water air content are reported. Calculation of air content is shown using results obtained with the Brand, Van Slyke, and MERL (Mechanical Engineering Research Laboratory) and for determining air content from results obtained with a dissolved oxygen meter. The results from each of these methods are discussed. It is concluded that the Brand apparatus is reliable, consistent, safe, and simple to operate. It is superior to the Van Slyke apparatus when the inconsistency and senstivity of the particular Van Slyke apparatus are considered. The Brand apparatus extracts more air from water than the Van Slyke. The MERL apparatus may be faster than the Brand apparatus, but its method of measuring air content is laborious, and there is a probability that some air will remain in the water after the spraying process. The free air content in water can be determined from the difference between the Brand measurements of total air and the dissolved oxygen meter measurements adjusted to dissolved air. (Rochester-PTT)
W87-03038

INTERPRETATION OF TRACER DATA IN VARIABLE FLOW SYSTEMS,
Institute of Physics and Nuclear Techniques, Krakow (Poland).
A. Zuber.
Journal of Hydrology JHYDA7, Vol. 86, No. 1/2, p 45-57, September 1986. 1 fig, 15 ref, append.

Descriptors: *Environmental tracers, *Varied flow, *Tracers, *Fluctuations, *Groundwater movement, *Data interpretation, Injection, Stagnant water, Flow profiles, Flow patterns.

There have been several attempts to solve the problem of tracer experiments in unsteady flow. A general formula for the interpretation of tracer experiments in variable flow has been derived, based on a generalization of the transit (exit) time distribution of the tracer mass flux resulting from an instantaneous injection. Systems with a constant volume and constant turnover time of the dynamic part of the system are considered. The interpretation of tracer data provides only the mean transit time of tracer, which is usually greater than the mean transit time of water, due to diffusion into stagnant water pores and zones. Thus the interpretation may yield erroneous information on the mobile water in the system, if the retardation factor remains unknown. On the other hand, large stagnant zones (e.g., sedimentation pockets which are not easily accessible to tracer diffusion) will not respond to the flow changes, and will not significantly delay the movement of the tracer. Thus, they will not be included in the volume determined either from the analysis of the flow data or from tracer data. (Alexander-PTT)
W87-03070

EVAPORATION DATA FROM A CAPILLARY EVAPORIMETER,
Agricultural Univ., Wageningen (Netherlands). Dept. of Physics and Meteorology.
A. F. G. Jacobs, N. J. Bink, and R. Williams.
Journal of Hydrology JHYDA7, Vol. 86, No. 1/2, p 85-92, September 1986. 4 fig, 10 ref.

Descriptors: *Evaporation, *Capillary evaporimeters, *Measuring instruments, *Data acquisition, Heat transfer, Capillary atmometer, Piche atmometer, Performance evaluation, Atmometers.

A new type of instrument was used to estimate evaporation figures. A model of which was presented. The model describes the measurements well for the 0.30 m level. For the 1.50 m level, however, there is a systematic underestimation of about 8%. This discrepancy is probably caused by uncertainties in the coefficient of heat transfer, h. The results for the Piche atmometer and capillary atmometer are quite similar, making the instruments interchangeable. However, the capillary atmometer has about a 50% higher sensitivity. The results of the capillary atmometer are very well correlated (r = 0.97 for the 3.0 m readings) with previously attained potential evaporation figures. This instrument therefore offers a relatively cheap alternative for estimating evaporation figures. At one point, there exists an important difference between the capillary atmometer and all other types of evaporimeters. In its present shape, the capillary atmometer has a short measuring time; as an average, one measurement takes about one minute. Whether this is an advantage or disadvantage depends on the objective of the measurements; long-term studies would be expensive and time consuming because many measurements would have to be taken to obtain and average, while a study of extreme values would be very inexpensive with this method, because of the speed with which the instrument can take measurements. (Lantz-PTT)
W87-03073

SELECTIVE WITHDRAWAL: BASIC CONCEPTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8B.
W87-03222

EVALUATION OF THE FACTORS GOVERNING THE MOBILITY OF DREDGED MATERIAL PLACED AT OPEN WATER DISPOSAL SITES,
Connecticut Univ., Groton. Marine Sciences Inst.
For primary bibliographic entry see Field 5E.
W87-03252

PRINCIPLES UNDERLYING THE DEVELOPMENT OF WATER QUALITY MONITORING SYSTEMS IN HUNGARY,
Vizgazdalkodasi Tudomanyos Kutato Intezet, Budapest (Hungary).
For primary bibliographic entry see Field 7A.
W87-03303

REAL TIME WATER QUALITY FORECASTING MODELS BASED ON THE WATER QUANTITY/QUALITY RELATIONSHIP,
Vrije Univ., Brussels (Belgium). Lab. of Hydrology.
For primary bibliographic entry see Field 5A.
W87-03304

CONTROLLING SUSPENDED SEDIMENT SAMPLERS BY PROGRAMMABLE CALCULATOR AND INTERFACE CIRCUITRY,
Pacific Southwest Forest and Range Experiment Station, Berkeley, CA.
R. E. Eads, and M. R. Boolootian.
Research Note PSW-276, October 1985. 8 p, 3 fig, 3 ref, 2 append.

Descriptors: *Suspended sediments, *Sediment samples, *Measuring instruments, Computers, Electrical equipment, Water sampling, Stream discharge, Gages, Sediments.

A programmable calculator connected to an interface circuit can control automatic samplers and record streamflow data. The circuit converts a voltage representing water stage to a digital signal. The sampling program logs streamflow data when there is a predefined deviation from a linear trend in the water elevation. The calculator estimates suspended sediment discharge from rating coefficients for the gauging site. When a threshold value of accumulated suspended sediment discharge is reached, the calculator sends a signal to the interface circuit that activates a pumping sampler. The sampling program is easily updated, and data are transferred to a computer by using a digital cassette recorder. This system increases sampling flexibility and efficiency. (Author's abstract)
W87-03337

7C. Evaluation, Processing and Publication

FEW DATA ABOUT INDEPENDENT PRODUCERS OF HYDROELECTRICITY IN FRANCE, (QUELQUES DONNEES SUR LA PRODUCTION HYDROELECTRIQUE AUTONOME EN FRANCE),
Electricite de France, Paris. Direction de l'Equipement.
For primary bibliographic entry see Field 8C.
W87-02567

STRUCTURING OF ECOLOGICAL DATA SETS BY METHODS OF CORRELATION AND CLUSTER ANALYSIS,
Kiel Univ. (Germany, F.R.). Inst. fuer Polarokologie.
For primary bibliographic entry see Field 2L.
W87-02597

STATISTICAL TECHNIQUE FOR ANALYSIS OF ENVIRONMENTAL DATA CONTAINING PERIODIC VARIANCE COMPONENTS,
Northeast Utilities Service Co., Hartford, CT.
E. Lorda, and S. B. Saila.
Ecological Modelling, Vol. 32, No. 1-3, p 59-69, June 1986. 2 fig, 9 ref.

Descriptors: *Statistics, *Model studies, *Long Island Sound, *Data interpretation, *Harmonic regression, *Periodic regression, Fourier series, Biorhythms, Waterford, Connecticut, Nuclear powerplants, Winter flounder, Impingement.

A statistical technique is described for analyzing data containing periodic variance components when the observations are made at irregular intervals. It uses a less constrained version of harmonic or periodic regression than usually is employed. The main feature of this method is that a known period is hypothesized and its component is removed from the data if it is found to be significant. This is in contrast to searching for the presence of unknown periodic components following a classic Fourier series. For environmental monitoring programs, biological rhythms may create special problems in estimating average abundance at one or more stations sampled at different times. Correct interpretations of sampling data of this type become even more difficult when time series data are obtained at irregular intervals and the objective is trend monitoring for environmental disturbances. The steps in the analysis are described in detail, and the method is applied to the abundance of winter flounder (Pseudopleuronectes americanus) captured at the intake of the Millstone nuclear power plant, Waterford, Connecticut. (Author's abstract)
W87-02599

INTERACTIVE ALGORITHM FOR THE PARAMETER ESTIMATION OF COMPLEX SYSTEMS AND ITS APPLICATION TO AN ECOLOGICAL MODELLING OF AN ACTUAL JAPANESE LAKE,
Science Univ. of Tokyo (Japan). Dept. of Management Science.
For primary bibliographic entry see Field 2H.
W87-02600

GENERALIZATION AND APPLICATIONS OF TRACER DISPERSION DATA,
Geological Survey, Reston, VA. Water Resources Div.
For primary bibliographic entry see Field 5B.
W87-02620

NEW ANALOGUE COMPUTER FOR THE STUDY OF PUMPING TESTS UNDER FALLING WATER-TABLE CONDITIONS,
British Geological Survey, Wallingford (England).
For primary bibliographic entry see Field 7B.
W87-02854

NURSERY IRRIGATION-SYRINGE SYSTEM THAT MONITORS ENVIRONMENTAL PARAMETERS,
Texas A and M Univ., College Station. Dept. of Physics.
M. C. Riondo, and F. T. Davies, Jr.
Hortscience HJHSAR, Vol. 21, No. 31, p 523-524, June 1986. 2 fig, 2 ref.

Descriptors: *Digital automated irrigation syringe, *Monitoring, *Irrigation cycles, *Intermittent irrigation, *Nurseries, *Greenhouse cultivation, Horticulture, Plant growth, Modeling, Water requirements, Air temperature, Soil temperature, Plant water relations, Plant physiology, Irrigation.

A digital automated irrigation syringe (DAIS) system is described that monitors environmental conditions for efficient plant cooling and water usage. The devices consists of a short-cycle syringe irrigation control (intermittent irrigation) for reducing heat load and long time cycle control for applying larger volumes of water during predetermined irrigation cycles. The syringe (intermittent irrigation) control is operated by selecting threshold levels based on soil and air temperatures and soil moisture. The longer time cycle control is based on a 24-hr cycle that provides regular cyclic irrigation adjusted for daily irrigation numbers(s) and time length of each irrigation. The DAIS system can be used in nursery container and greenhouse production and can be applied to modeling of growth at different water regimes to determine water requirements for optimum crop growth. (Author's abstract)
W87-03107

REGIONAL ANALYSIS OF WATER QUALITY IN MAJOR STREAMS OF THE UNITED STATES,
Woodward-Clyde Consultants, Englewood, CO.
For primary bibliographic entry see Field 5G.
W87-03284

STATISTICAL METHODS FOR RESERVOIR WATER QUALITY INVESTIGATIONS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Environmental Lab.
R. F. Gaugush.
Available from the National Technical Information Service, Springfield, VA. 22161. Instruction Report E-86-2, June 1986. Final Report. 216 p, 23 fig, 44 tab, 23 ref, append.

Descriptors: *Statistical methods, *Water quality, *Reservoirs, *Data interpretation, Statistical analysis, Multivariate analysis, Monitoring.

This report presents an introduction to the statistical analysis of water quality data. Techniques from the use of simple data displays to the application of nonparametric and multivariate statistics are presented. Methods of data display are presented as a means of becoming familiar with the data and presenting those data. Basic descriptive statistics are discussed as a means to summarize the typically large data sets that result from a water quality monitoring program. The application of inferential statistics to make sound conclusions about differences, relationships, or trends within the data is also discussed. All of these methods are presented with concise and clear examples using actual water quality data. The report also provides an introduction to the statistical concerns involved in sample design that are necessary for the proper execution of a water quality monitoring program. (Author's abstract)
W87-03322

8. ENGINEERING WORKS

8A. Structures

PERFORMANCE OF CHINA'S FIRST CONCRETE CUT-OFF WALL,
Huazhong Univ. of Science and Technology, Wuhan (China). Inst. for Hydroelectric Energy Resources.
D. Zhau.
Water Power and Dam Construction, Vol. 38, No. 8, p 24-25, August 1986. 2 fig.

Descriptors: *Cut-off walls, *Flow path, *Leakage, *China, *Grout curtain, Sedimentation, Seismic activity, Performance, Groundwater level, Dams, Alluvial deposits, Coefficient of permeability.

China's first concrete cut-off wall was built in 1960. The concrete cut-off wall, together with a cement grout curtain and clay filled flanks, form part of the Baihe main dam which stands on alluvial foundations. The alluvial deposits concerned have a coefficient of permeability of 800 m/d. The cut-off structure covers an area of 25 500 sq m, with a maximum length and depth of 795 m and 44 m respectively. The cut-off structure was designed with a practical half-life of 50 years. The condition and performance of the structure halfway through through that period is reported. (Alexander-PTT)
W87-02689

RCC: A DAM REHAB SOLUTION UNEARTHED,
Portland Cement Association, Denver, CO.
For primary bibliographic entry see Field 8F.
W87-02770

EFFECTIVE TECHNOLOGY OF CONSTRUCTING EARTH STRUCTURES,
Yu. K. Sevenard, M. P. Pavchich, and O. A. Pakhomov.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 12, p 635-639, December 1985. 4 fig, 4 ref. Translated from Gidtrotekhnicheskoe Stroitel'stvo, No. 12, p 4-7, December 1985.

Descriptors: *Earthworks, *Technology, *Construction, *Hydraulic structures, *Construction methods, *Embankments, *Structural engineering, Flood control, Dikes, Cofferdams, Excavation, Cold regions, Rock fill, Cold weather construction, Rock excavation, Excavation, Leningrad, Russia.

An effective technology for constructing earth structures was developed and introduced for the construction of the flood control complex of Leningrad, and can be adapted to local conditions elsewhere. The bulk of construction and installation was accounted for by protective dikes, cofferdams, and other earth embankments. The technology and design features are discussed. A special problem was that of construction in winter, when, owing to the thick ice cover in the bay, it becomes impossible to dump soil into the water. An original solution was developed, using two floating cranes advancing into the bay as the front of the earthworks advanced. This method operated reliably over several winter seasons. (Doria-PTT)
W87-02864

CHARACTERISTICS OF THE STATIC PERFORMANCE OF DAMS RESERVOIRED HYDROELECTRIC STATIONS,
A. N. Marchuk, A. A. Khrapkov, Y. N. Tsukerman, and M. A. Marchuk.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 12, p 646-652, December 1985. 7 fig, 8 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 12, p 12-16, December1985.

Descriptors: *Performance evaluation, *Dams, *Reservoirs, *Hydroelectric plants, *Stress analysis, Powerplants, Concrete dams, Structural engineering, Hydraulic structures, Dam design, Dam stability, Dam construction, Foundation failure, Concretes.

The location of powerhouses, for hydroelectric stations near the dam is economically advantageous. However, an analysis of the stress-strain state of the largest concrete dams on the basis of on-site observations showed certain shortcomings of this design. One factor involved was the increase in deformation of foundations under downstream shoulders of the powerhouse sections of dams. The state of stress of a dam and foundation

from the main static loads was examined. Hydrostatic pressure from the upper pool (normal pool level 296.25 m), dead weight, and uplift taken from the data of on-site observations were taken into account with the seasonal temperature fluctuations. The very cold winter of 1977 was selected for calculations of negative temperatures. To eliminate the static load shortcoming, it was necessary to provide measures in the designs to increase the rigidity of the foundation under the downstream shoulder of the dam. This requires: (1) increasing the distance between the foundation of the downstream face and axis of the turbine-generator units, (2) not allowing large differences in the elevations of the base of the dam and hydroelectric station, (3) providing for grouting, and (4) maximally shorten the time between rock excavation and placing the concrete in the pits. (Doria-PTT)
W87-02866

EFFECT OF THE SHAPE OF THE TRANSITION SECTION ON HEAD LOSSES IN INTAKES OF A PUMPED-STORAGE STATION,
I. E. Mikhailov, and A. I. Kuz'menko.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 12, p 652-660, December 1985. 4 fig, 1 tab, 2 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 12, p 16-21, December1985.

Descriptors: *Pumped storage, *Hydroelectric plants, *Head loss, *Intakes, *Hydraulic engineering, *Hydraulic design, Storage, Powerplants, Hydraulic structures, Reservoirs, Structural engineering.

The effect of various structural elements on head loss in the intakes of upper reservoirs of pumped-storage stations, was studied. It was found that in intakes for straight variants and for layouts with bends, the coefficients of head losses in the pump operating regime are two to three times greater than in the turbine. The bend affects the value of losses in elements of the intake located above it, so that a reliable value of the resistance coefficient of an intake with a bend in the pump, can be obtained only experimentally. Intakes with various degrees of expansion, and transition section 2 from a circle to a rectangle located between the bend and intake proper, have smaller head losses than intakes with transition section 1 from a circle to a square for all angles of turn of the bend, both in the pump and in the turbine regimes. In the turbine operating regime, the total coefficients of head loss increases with an increase of the angle of the turn of the bend. Additional results are discussed. (Doria-PTT)
W87-02867

EXPERIENCEIN THE MANUFACTURE AND INSTALLATION OF THE REINFORCED CONCRETE-ENCASED STEEL PIPELINES OF THE ZAGORSK PUMPED-STORAGE STATION,
A. E. Redreev.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 12, p 671-679, December 1985. 8 fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 12, p 27-32, December 1985. 8 fig.

Descriptors: *Fabrication, *Installation, *Pipelines, *Pumped storage, *Hydroelectric plants, *Steel, *Reinforced concrete, *Hydraulic structures, Storage, Powerplants, Concretes, Construction, Hydraulic construction, Technology, Economic aspects, Costs, Construction costs.

At the Zagorsk pumped-storage station, designs and technology of off-site manufacture of reinforced concrete-encased steel pressure pipeline were highly efficient, and reduced labor expenditures compared with on-site fabrication and permited much of the work to be performed at casting yards under industrial conditions. The creation of unique mechanisms and equipment for manufacturing and installing the links of the pipeline, united into a single technological flow, made it possible to considerably increase labor productivity during the manufacture and installation of the pipeline throughout construction of the Zagorsk pumped-storage station. The productivity of the entire technological line is determined by the productivity of manufacturing the reinforcing cages, while a developed quality-control system provides a high quality of work. Intermediate buffer storage between the operation of the flow, made it possible to provide a functional plant-type technological flow, for the series production of unique structures. The development and introduction of the special 2 x 50-ton installation mechanism considerably increased the reliability and flexibility of the installation scheme and reduced the labor intensity of installation. (Doria-PTT)
W87-02869

PSKEM HYDRO DEVELOPMENT ON THE PSKEM RIVER,
V. P. Nikonorov.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 12, p 680-687, December 1985. 4 fig. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 12, p 33-37, December 1985.

Descriptors: *Hydroelectric plants, *Pskem River, *Water resources development, *Hydraulic engineering, *Hydraulic design, Powerplants, Water supply, Engineering, Hydraulic structures, Reservoirs, Resources development, Water supply development, Economic aspects, Dam design, Construction engineering, Tunnels, Excavation, Construction, Russia.

The Pskem River flows through the territory of the Uzbek SSR, with a basin located in mountainous regions, and a drop of 740 m. The potential hydropower resources of the Pskem River are 3.6 billion kWh. A cascade of four hydro developments is proposed for using the water resources of the river, with an installed capacity of 1250 MW, and a normal annual production of electrical energy of 3056 GWh. This development, with its multipurpose reservoir, solves the problem of providing a firm water supply to the population and industry of the Tashkent-Chirchik agglomeration. It also compensates seasonal power regulation of the runoff with participation in covering the peak loads, creates favorable conditions for recreational activities developes the infrastructure of the region, and improves water supply to agriculture. The design and economic aspects of the development are discussed. (Doria-PTT)
W87-02870

METEOROLOGICAL DATA ANALYSIS FOR DRAINAGE SYSTEM DESIGN,
Toronto Univ. (Ontario). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2B.
W87-02882

WATERLINE PROBLEMS CAN BE AVOIDED WITH CARE AND TESTING,
MEI-Charlton, Inc., Portland, OR.
D. Valley.
Public Works PUWOAH, Vol. 117, No. 7, p 61-62, July 1986.

Descriptors: *Materials testing, *Maintenance, Construction joints, Pipelines, Pipes, Conveyance structures, Temperature.

A number of waterline failures were examined, and although none of these failures were identical in nature they all pointed to certain common-sense precautions that can be taken. A cast iron waterline failed because the protective coating on the pipe was missing from 30 percent of the exterior surface, which corroded the pipe beyond repair. One central Oregon city tested a 12-inch municipal waterline that had failed a hydrostatic test after installation. Several joints were removed, and had to be taken to a lab for testing. Time and a great deal of money could have been saved if the joints had been tested prior to installation. A third case took place in a Rocky Mountain city where a 110-inch welded steel pipe joint developed circumferential cracks near the inside of the lap joint fillet weld during installation. It was found that the metal had a very low notch toughness at low temperatures (40 F and below). While the pipe was fine in normal conditions it became brittle in the cold temperature in which it was installed. The conclusions to be drawn from this is that care and common sense must be practiced in all phases of design and installation. (Khumbatta-PTT)
W87-02904

PUMP STATION GETS NAVY DISCHARGE AND NEW LIFE AS CIVILIAN,
Tatman and Lee Associates, Wilmington, DE.
For primary bibliographic entry see Field 5F.
W87-02925

CORDLESS GEO-DATA LINK,
Watermeyer, Legge, Piesold and Uhlmann, Ashford (England).
For primary bibliographic entry see Field 7B.
W87-03031

BOREHOLE TELEVISION FOR GEOTECHNICAL INVESTIGATIONS,
Westinghouse Electric Corp., Horseheads, NY. Industry and Government Tube Div.
For primary bibliographic entry see Field 7B.
W87-03032

DESIGNING INTAKES TO AVOID FREE-SURFACE VORTICES,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
For primary bibliographic entry see Field 8B.
W87-03034

COMPUTATION OF HYDRAULIC TRANSIENTS IN COMPLEX HYDRO SCHEMES,
Hydraulic Engineering Research Inst., Bucharest (Romania).
M. Popescu.
International Water Power and Dam Construction IWPCDM, Vol. 38. No. 9, p 35-40, September 1986. 4 fig, 9 ref, append.

Descriptors: *Hydroelectric power, *Computation procedure, *Surge tanks, *Hydraulic transients, *Liapunov function, Reservoirs, Tunnels, Conduits, Incompressible fluid models, Differential equations, Mathematical models, Tismana Hydro Station, Romania, Numerical analysis.

A general procedure is described for computation of hydraulic transients in complex hydro schemes (e.g, involving several reservoirs, tunnels, surge tanks, and power stations). A study of hydraulic transients was conducted in relation to the circumstances of the Cerna-Motru-Tismana hydro complex (Romania). The model of incompressible fluid was used and differential equations were written with respect to conduits between surge tanks and continuity equations with respect to the points connecting surge tanks and tunnels. The numerical procedure is set forth for the case of three surge tanks and examples of results are given for two applications: a theoretical hydro plant with three surge tanks and the Tismana (Romania) hydro stations, which has secondary shafts located at levels above 500 m. The Liapunov function approach was used to obtain the critical (horizontal) cross-sectional area of a surge tank; how this is done is described. Numerical tests confirmed the compatibility of Liapunov function results with those obtained by direct numerical analysis, confirming that this function may be used for preliminary design of surge tanks. (Rochester-PTT)
W87-03036

ROCKFALL-INDUCED WAVES IN RESERVOIRS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
For primary bibliographic entry see Field 8E.
W87-03037

COMPUTERIZED LAYOUT GENERATION FOR SANITARY SEWERS,
Yarmouk Univ., Irbid (Jordan). Dept. of Civil Engineering.
S. Tekeli, and H. Belkaya.
Journal of Water Resources Planning and Manage-

ment (ASCE) JWRMD5, Vol. 112, No. 4, p 500-515, October 1986. 4 fig, 8 tab, 16 ref, append.

Descriptors: *Computer programs, *Algorithms, *Sanitary engineering, *Design criteria, *Sewer systems, Wastewater, Gravity flow, Hydraulic design, Computers Cost analysis, Water transport, Network design, Mathematical studies.

A layout generation algorithm, (LGA) is developed for generation of sanitary sewer layouts, using a standard shortest path algorithm. For selection of the shortest path from each manhole to the final outlet, three sewer cost measures were formulated from the data on sewer lengths and surface elevations at the manholes. EX measure, which requires the definition of a hypothetical excavation volume for each sewer from the minimum cover depth and sewer slope, yielded the minimal excavations and invert depths when the generated layouts were hydraulically designed. The results were as good as, or better than, the layouts recommended for networks with up to 70 manholes. Due to computer memory restrictions, the larger networks must be subzoned for subsequent superposition. Guidelines are developed for subzoning as well as general implementation from testing of LGA with various-sized networks. (Author's abstract)
W87-03062

EVOLUTION OF PMP COOPERATIVE STUDIES,
Corps of Engineers, Washington, DC.
E. A. Stallings, A. G. Cudworth, E. M. Hansen, and W. A. Styner.
Journal of Water Resources Planning and Management (ASCE) JWRMD5, Vol. 112, No. 4, p 516-526, October 1986. 4 fig, 14 ref.

Descriptors: *Model studies, *Probable maximum precipitation, *Spillways *Hydrologic models, *Information exchange, Flood profiles, Hydrometeorology, Storms, Floods, Design flood, Statistical analysis, Spillway capacity, Catchment areas, Design standards, Dams.

A brief prospective of hydrologic analysis used for the determination of spillway sizing is presented. The procedures for determining a reasonable upper limit of flood potential for a given drainage basin is described. In 1936 The National Weather Service and the Corps of Engineers reached a cooperative agreement whereby meteorologists of the Weather Service would use their professional capabilities to develop probable maximum precipitation (PMP) estimates. This paper highlights the history of hydrometeorological aspects used in the design selection process of dams, spillways, and appurtenances. Uniform techniques are of paramount importance because of the issues involved in dam safety. A prime consideration is that the language of the meteorologist and the language of the hydrologist are becoming more similar. These two disciplines must work together to ensure a quality product. In recent years the Bureau of Reclamation and the Soil Conservation Service have joined forces with the Weather Service and the Corps of Engineers, in the preparation of hydrometeorological reports. The four agencies are presently engaged in a major study of maximum precipitation for the northwest United States. Information on major storms and floods is included that supports the hydrometeorological approach. The major federal dam agencies are meeting regularly and are using the same hydrometeorological approach to size spillways. (Author's abstract)
W87-03063

TIME AND TIDE ARE RIGHT FOR THE SEVERN BARRAGE,
H. Gavaghan.
New Scientist NWSCAL, Vol. 111, No. 1517, p 21-22, 17 July 1986.

Descriptors: *Tidal powerplants, *Severn Barrage, *Cost analysis, *Siltation, England, British Government, Hydroelectric powerplants, Financing, Private investment, Cooperative ventures.

The British Government recently announced its support for a feasibility stud of the barrage hydropower scheme projected to cross the Severn Estuary. The Severn Tidal Power Group estimated that a barrage between Weston-super-Mare and Cardiff could have a capacity of 7200 megawatts, provide 45000 jobs during construction, and generate between 25000 and 30000 more jobs in manufacturing and recreational industries. It would cost 5500 million pound sterling to build. An alternative scheme would cost about one-fifth as much, but produce 2.8 thousand billion kWh annually compared to 14.4 thousand billion kWh annually for the larger project. Obstacles to the approach include a possible siltation problem in the estuary and an insufficient rate of return to attract private investment. It is considered suitable for a public project or for a private-public cooperative venture. (Rochester-PTT)
W87-03091

DESIGNING FOR FLOW,
Drexel Univ., Philadelphia, PA. Dept. of Civil Engineering.
R. M. Koerner.
Civil Engineering CEWRA9, Vol. 56, No. 10, p 60-62, October 1986. 4 fig, 2 tab.

Descriptors: *Design citeria, *Flow characterisitics, *Materials engineering, Design standards, Design flow, Specifications, Hydraulic gradient.

A test device that experimentally evaluated the hydraulic characterisitics of high drainage composite cores was developed to generate design data for geotechnical engineering applications. The test device was capable of handling up to 100 gpm, hydraulic gradients from 0.06 to 2.0 and applied pressures up to 30 psi for indefinitely long times. The large size of the specimens (12 by 18 in.) is quite important because the flow regime through the various cores is very complex and deviations from full scale situations must be kept to a minimum. Working with large test specimens trends to avoid scale effects. It was concluded that a minimum flow rate at a stipulated hydraulic gradient and applied pressure must be considered when specifying geotextiles. (Michael-PTT)
W87-03125

USE OF GROUTING WHEN DRIVING THROUGH THE ROCK BURST ZONE IN THE DANGARA IRRIGATION TUNNEL,
For primary bibliographic entry see Field 8E.
W87-03181

RESTORATION OF PIPE DRAINAGE IN FOUNDATIONS OF HYDRAULIC STRUCTURES ON CARBONATE ROCKS,
L. V. Mazurenko, A. V. Shipilov, K. I. Anisimov, and A. V. Gorenko.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 2, p 107-110, February 1986. 2 fig, 5 ref. Translated from Gidrotekhnische Stroitel'stro, No. 2, p 33-34, February 1986.

Descriptors: *Pipes, *Drainage systems, *Hydraulic structures, *Carbonate rocks, Italy, Tunisia, Russia, Soil permeability, Drainage, Acids, Maintenance.

It is known from the practice of operating dams, navigation locks, and other hydraulic structures what high requirements are imposed on the reliability and service life of drainage systems in their foundations. Nevertheless, it is often necessary to construct these structures on easily and moderately soluble rocks, such as loose limestones, subjected to processes of chemical piping. Thus, the Harlan County (USA), Pontesei and Vaiont (Italy), Kasseb (Tunis), Chirkei and Dubossary (USSR), and other dams are located on carbonate rocks, where the unimpeded development of chemical piping can lead, and sometimes does lead, to a marked increase of permeability of the soil, to the formation of concentrated seepage pathways, and also to the loss of stability of the soil. With construction under such conditions, drainage systems under the hydraulic structures, clogging of the drainage by products of disintegration of the foundation and its failure are observed. When designing drained hydraulic structures on carbonate rocks subject to piping processes, it is necessary to provide for the possibility of periodic inspections of the drainage systems, and cleaning in the case of clogging by products of chemical piping. When conducting works on the restoration of drainage in cases where clogging by the disintegration products of carbonate rocks of the foundation, good results are obtained by measures combining dissolution of the mineral deposits by hydrochloric acid with mechanical cleaning of the drains by special jet hose nozzles. When performing restoration works in drainage systems using acid, strict control of the concentration of acid entering the water basin after flushing the drains is imperative. (Lantz-PTT)
W87-03184

DIMENSIONLESS ANALYSIS OF OPTIMUM DESIGNS,
V. A. Makarov, and Y. N. Tyukhanov.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 2, p 111-115, February 1986. 2 tab, 6 ref. Translated from Gidrotekhnische Stroitel'stro, No. 2, p 35-38, February 1986.

Descriptors: *Dimensional analysis, *Hydraulic design, *Mathematical analysis, Mathematical studies, Hydraulic structures, Hydraulic machinery, Optimization.

Problems of selecting the optimum variant of a design on the basis of some dominant criterion are often encountered in design practice. In this case, striving to obtain the most reliable result, taking into account the maximum number of influencing factors, leads to complications of calculated relations, due to the inclusion of additional quantities without due analysis, all of which affect the final conclusions. Presented here is a mathematical analysis of the region with stability of optimization of the design velocity of water in power conduits of a hydroelectric station. The use of dimensionless analysis proved to be an effective method for estimating the boundaries of the region of stability in the optimization of designs. This permits reducing the volume of calculations by eliminating little representative factors, the absolute value of which is less than the value of the error in determining the dominant costs. A correct estimation of the region of stability of solutions in optimization problems, in addition to simplifying calculations, permits taking into account real design and industrial factors not having a direct quantitative evaluation, and overlooked in calculations. This then promotes making the best technological and feasible technical decision. (Lantz-PTT)
W87-03185

CONSTRUCTION OF DAMS ON SOILS CONTAINING SOLUBLE SALTS,
For primary bibliographic entry see Field 8E.
W87-03186

DEVELOPMENT OF A COLLISION TOLERANT PILE STRUCTURE CONCEPT,
New Hampshire Univ., Durham.
M. R. Swift, and K. C. Baldwin.
Ocean Engineering OCENBQ, Vol. 13, No. 2, p 131-156, 1986. 18 fig, 3 tab, 6 ref.

Descriptors: *Structural engineering, *Piles, *Performance evaluation, *Structural behavior, *Simulation analysis Rigid foundations, Collision tolerant pile structure, Navigation, Buoys, Mathematical models, Model studies, Computer models.

A Collision Tolerant Pile Structure (CTPS) for deploying navigation aids was developed having the ability to sustain collisions by barge traffic. The CTPS concept consists of the aid itself mounted at the top of a pile which is hinged at the mudline. The hinge is omnidirectional, possesses complete downward articulation, and provides a restoring moment to return the structure to the vertical position. To serve as a design tool, mathematical models were developed for simulating pile dynamics during operating, hurricane and collision conditions. Using preliminary modeling results, a hinge component consisting of a central universal joint,

peripheral stay arrangement was selected. A design based on this concept was developed, and a physical scale (1/15) model was built for testing. Initial experiments were conducted out of water to evaluate hinge stiffness characteristics, then uniform current tests were conducted at the Coast Guard Academy's circulating water channel. Results from both experiments indicate that the CTPS has enough stiffness to remain sufficiently vertical while acted upon by current, wind and wave loadings. Collision experiments carried out at the UNH indoor pool, showed that the pile can endure barge collisions. A final computer model simulation predicted that the full-scale CTPS design presented here should meet the design requirements. (Author's abstract)
W87-03219

PROCEEDINGS: CE WORKSHOP ON DESIGN AND OPERATION OF SELECTIVE WITHDRAWAL INTAKE STRUCTURES.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
Available from the National Technical Information Service, Springfield, VA. 22161. June 24-28, 1985, San Francisco, California. Miscellaneous Paper HL-86-3, May 1986. Final Report. 202 p.

Descriptors: *Conferences, *Selective withdrawal, *Outlets, *Intakes, *Structural engineering, Information exchange, Discharge capacity, Water quality management, Reservoir operation.

The objective of the workshop was to assemble the personnel within the Corps of Engineers (CE) who have had experience in the design and operation of selective withdrawal structures and thereby provide a forum for information exchange and identification of common problems arising in either design or operation of these structures. Papers were solicited from across the CE and the resulting mix of topics represents a significant portion of the available information and experience within the CE on design and operation of selective withdrawal structures. At the workshop, two items of structure design were highlighted in presentations and discussions: discharge capacity and multilevel withdrawal flexibility. Limited capacity and limited flexibility were identified as the most common constraints in meeting particular water quality objectives. Another common problem cited in the papers was the long-term modifications of the project's operational objectives and, as a consequence, the lack of capability to meet the present objectives with the existing structure. Case studies of structural and operational modifications to meet release objectives were presented. (See also W87-03222 through W87-03247) (Author's abstract)
W87-03221

HYDRAULIC DESIGN OF THE SELECTIVE WITHDRAWAL STRUCTURES OF THE LOST CREEK DAM,
Army Engineer District, Portland, OR.
F. Hall.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 19-21, 1 fig.

Descriptors: *Dam design, *Water quality control, *Selective withdrawal, *Lost Creek Dam, *Hydraulic design, Discharge measurement, Head loss, Flow velocity, Nitrogen.

The hydraulic design of a selective withdrawal structure for the Lost Creek Dam is based on a single wet well design. Operating parameters such as discharge rate, head loss and flow velocity are discussed, along with the structural measurements of the dam. The design of the structure also incorporates a method to retain a nitrogen supersaturation level downstream, enabling a multimillion dollar fish hatchery to continue operation. (See also W87-03221) (Lantz-PTT)
W87-03223

HYDRAULIC DESIGN OF THE SELECTIVE WITHDRAWAL STRUCTURES OF THE APPLEGATE DAM,
Army Engineer District, Portland, OR.
F. Hall.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 22-25, 2 fig.

Descriptors: *Dam discharge, *Water quality control, *Selective withdrawal, *Applegate Dam, *Hydraulic design, Discharge measurement, Head loss, Flow velocity, Temperature.

The hydraulic design of this withdrawal structure is based on a dual wet well design. Operating parameters such as discharge rate, head loss and flow velocity are discussed, along with the structural measurements of the dam. The design of the structure also incorporates a method which aids in regulating the temperature requirements for fish enhancement at a fishery downstream. (See also W87-03221) (Lantz-PTT)
W87-03224

HYDRAULIC DESIGN OF THE SELECTIVE WITHDRAWAL STRUCTURES AT THE ELK CREEK DAM,
Army Engineer District, Portland, OR.
F. Hall.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 26-27, 1 fig.

Descriptors: *Dam design, *Water quality control, *Selective withdrawal, *Elk Creek Dam, *Hydraulic design, Discharge measurement, Head loss, Flow velocity.

The hydraulic design of a selective withdrawal structure for the Elk Creek Dam is based on a single wet well design. Operating parameters such as discharge rate, head loss and flow velocity are discussed, along with the structural measurements of the dam. The design of the structure also incorporates a method to retain a nitrogen supersaturation level downstream, enabling a multimillion dollar fish hatchery to continue operation. (See also W87-03221) (Lantz-PTT)
W87-03225

MODELING OF SELECTIVE WITHDRAWAL INTAKE STRUCTURES,
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 5G.
W87-03230

BLOOMINGTON DAM, POTOMAC RIVER WATER QUALITY OUTLET,
Corps of Engineers, Omaha, NE.
For primary bibliographic entry see Field 5G.
W87-03231

WATER QUALITY OUTLET WARM SPRINGS DAM,
Corps of Engineers, Omaha, NE.
For primary bibliographic entry see Field 5G.
W87-03232

HYDRAULIC DESIGN: BLOOMINGTON LAKE AND F. E. WALTER DAM PROJECT'S SELECTIVE WITHDRAWAL STRUCTURES,
Corps of Engineers, Baltimore, MD. Baltimore District.
D. Seibel.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 71-76, 3 fig.

Descriptors: *Bloomington Lake, *F.E. Walter Dam, *Selective withdrawal, *Water quality control, Dam design, Gates, Reservoirs, Bear Creek, Nebraska, Hydroelectric plants.

Bloomington's selective withdrawal structures (SWS) was designed by the Omaha District, who also designed Warm Springs. The wet well is in effect a small standpipe with a short radius bend at its bottom to direct water towards the discharge control (or quality control (QC)) gate. The wet well has multiple inlets discharging into it at a 90 degree angle with no flare or transition to guide the flow into the wet well. Also, the wet well does not extend above the conservation pool level. A small diameter air vent is provided at the top of each wet well. At pool levels approaching the conservation pool level, water is forced up into the air vent. In addition, at large QC gate settings, (i.e., discharges approaching the capacity of the SWS) the intake tower was observed to vibrate. The program of testing currently underway to determine the cause of the vibration will be presented along with some preliminary findings. Also, a private interest is currently developing a proposal to add hydropower to the project. The design of the new multi-level intake tower which was necessitated by a proposal to raise the reservoir (Bear Creek) behind F. E. Walter Dam 250 ft is presented. The selective withdrawal system was designed using state-of-the-art design guidance. The system components were made as large as possible to minimize velocity effects. In an attempt to avoid problems similar to those presently being experienced at the Bloomington project by the hydropower proposal, provisions for later hydropower addition were made in the design of the F. E. Walter intake structure. (See also W87-03221) (Lantz-PTT)
W87-03233

DETERMINATION OF SELECTIVE WITHDRAWAL SYSTEM CAPACITY FOR INTAKE TOWER DESIGN,
Corps of Engineers, Baltimore, MD. Baltimore District.
For primary bibliographic entry see Field 5G.
W87-03234

DESIGN OF SELECTIVE WITHDRAWAL INTAKE STRUCTURES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
J. P. Holland.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 99-104, 14 ref.

Descriptors: *Selective withdrawal, *Water quality control, *Intakes, *Structures, Hydraulic properties, Hydrologic properties, Water quality, Structural behavior, Dam operation, Design standards, Reservoirs.

Presented in this paper is an overview of the general methodology used by the US Army Corps of Engineers in the design of selective withdrawal intake structures. The design of these structures requires a multidisciplinary approach due to the inherent coupling of hydraulic, hydrologic, water quality, structural, and operational concerns. Although there are several different types of selective withdrawal structures within the CE, each of these has a common goal: the maintenance of some prescribed downstream release and in-reservoir water quality objectives. Effective maintenance of a prescribed water quality objective, however, requires that the selective withdrawal structure be designed so that an adequate number of intakes are appropriately located to allow flexibility of operation over a wide range of hydrometeorological conditions. Further, these structures must be designed to satisfy numerous hydraulic constraints to ensure that the quality and quantity of water desired can be physically withdrawn. The design of a structure that is environmentally and hydraulically efficient requires a thorough understanding of both the hydromechanics of density-stratified flow in reservoirs and the control of flow in hydraulic structures. The methodology presented herein makes direct use of engineering tools based on experience in these two areas for the design of selective withdrawal structures. (See also W87-03221) (Lantz-PTT)
W87-03237

THOUGHTS AND CONSIDERATIONS FOR HYDRAULIC DESIGN,

For primary bibliographic entry see Field 8B.
W87-03241

SELECTIVE WITHDRAWAL STRUCTURE OPERATION EXPERIENCES IN ORD,
Army Engineer Div. Ohio River, Cincinnati.
D. Buelow.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 147-151.

Descriptors: *Selective withdrawal, *Hydraulic structures, *Ohio River, *Water quality control, Design standards, Temperature, Dissolved oxygen, Lakes, Dams.

More than one-third of the 75 reservoir projects in the Ohio River Division (ORD) have multi-level intake structures ranging from fixed high level riser to single and dual wet-well systems. Many of the structures were designed and constructed without the benefit of reservoir heat budget/withdrawal zone analysis, the oldest one having been placed in operation in 1952. Operational objectives at these projects are primarily for temperature control. However, the flexibility inherent in the structure designs is frequently used to enhance other quality characteristics such as dissolved oxygen, and to ameliorate problems such as high levels of iron, manganese and hydrogen sulfide. Some do not have a strict downstream objective and are operated in the best interests of the lake and tailwater. Data collection efforts in support of operation vary from minimal to adequate. Problems encountered include insufficient flexibility in withdrawal elevation, insufficient design discharge capacity and undersized hydraulic features. This presentation provides an overview of ORD experiences in the conceptualization and operation of selective withdrawal structures. Specific topics addressed are: types and capabilities of selective withdrawal structures in use; operation criteria; data collection; overall performance; problems encountered; and future problems, specifically hydropower retrofit at existing dams. Specific projects are used to demonstrate the salient features and operational capabilities. Central to all discussions is the integration of water quality considerations with research and regulation activities to yield a comprehensive water management framework. (See also W87-03221) (Author's abstract)
W87-03243

OVERVIEW OF PITTSBURGH DISTRICT SELECTIVE WITHDRAWAL OPERATION EXPERIENCES,
Army Engineer District, Pittsburgh, PA.
For primary bibliographic entry see Field 5G.
W87-03244

SELECTIVE WITHDRAWAL FROM ANY LEVEL BETWEEN MINIMUM POOL AND SPILLWAY ELEVATION AT STONEWALL JACKSON DAM, WEST VIRGINIA,
Army Engineer District, Pittsburgh, PA.
J. C. Gribar, and R. W. Schmitt.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 158-164, 1 fig.

Descriptors: *Selective withdrawal, *Water level, *Stonewall Jackson Dam, *Water quality control, *West Virginia, Spillways, West Fork River, Reservoirs, Stratification, Thermal stratification, Temperature, Reservoir operation, Iron, Manganese.

Stonewall Jackson Dam is a multi-purpose project located on the West Fork River and has a drainage area of 102 sq mi. Storage at spillway crest is 75,000 acre-ft, with a maximum depth of 75 ft. A fixed-port intake system was considered initially to meet outflow requirements. This consisted of two wells at the upstream face of the dam, each with four fixed-level intakes. The port elevations for this scheme were positioned using a computerized thermal simulation of the lake. Because of summer stratification conflicts between a rigid downstream water temperature schedule and outflow water quality objectives and restrictions, a more flexible withdrawal design was desired. Of primary concern was the problem of blending cool hypolimnetic waters into the discharge to support a downstream trout fishery during the summer when the deeper, colder strata of the lake are expected to have unacceptably high iron and manganese concentrations. An additional area of concern was a potential problem of turbid temperature-density currents penetrating the lake near the elevation of a fixed intake. With a fixed port intake works, circumstances could develop where outflow temperature goals would have to be sacrificed in the interest of water quality. Therefore, alternative withdrawal schemes were investigated. The adopted design is an innovative arrangement consisting of two separate towers projecting from the upstream face of the dam, each with three movable gate leaves to allow for withdrawal of waters from any level between the spillway elevation of 1082 and the minimum pool elevation of 1038. As such, it becomes possible to withdraw from the 20 C target water temperature level without having to use any of the deep, cold, high iron-content waters. It may also become possible to withdraw simultaneously from more than one level into the same tower. (See also W87-03221) (Lantz-PTT)
W87-03245

SELECTIVE EXPERIENCES: ALIAS WITHDRAWAL PAINS,
Corps of Engineers, Huntington, WV. Huntington District.
For primary bibliographic entry see Field 6B.
W87-03246

DESIGN AND PERFORMANCE OF SKIMMING WEIRS IN THE KANSAS CITY DISTRICT,
Corps of Engineers, Kansas City, MO. Kansas City District.
W. M. Linder.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 171-177, 4 fig.

Descriptors: *Selective withdrawal, *Performance evaluation, *Weirs, *Kansas City, *Water quality control, Skimming, Hydroelectric plants, Reservoirs, Reservoir management, Inlets, Inlet wells.

Two distinctly separate techniques have been used to meet water quality requirements downstream of Kansas City District lakes. These are (1) underwater skimming weirs at two hydroelectric power plants and (2) multilevel gated low flow intakes in conventional reservoir outlet structures. The three different types of multilevel intakes used include: (1) multilevel gated inlets discharging into a wet well, (2) a wet well with the upstream face composed of stop logs with one or more openings that can be placed at any desired elevation, and (3) multilevel gated inlets discharging through individual pipes into the flood control conduit. Observed field data show the skimming weirs are performing their intended function very well. No specific field data have been collected on the performance of the multilevel gated intakes. However, no downstream water quality problems have been observed as a result of their operation. (See also W87-03221) (Author's abstract)
W87-03247

MANAGEMENT OF BOTTOM SEDIMENTS CONTAINING TOXIC SUBSTANCES.
Army Engineer Inst. for Water Resources, Fort Belvoir, VA.
For primary bibliographic entry see Field 5G.
W87-03248

RIPRAP STABILITY AND NAVIGATION TESTS FOR THE DIVIDE-CUT SECTION TENNESSEE-TOMBIGBEE WATERWAY,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
S. T. Maynord, and N. R. Oswalt.
Available from the National Technical Information Service, Springfield, VA. 22161 as AD-A170323, A04 in paper copy, A01 in microfiche. Technical Report HL-86-3, May 1986. Final Report. 58 p, 1 tab, 21 plates, 29 ref.

Descriptors: *Riprap, *Slope stability, *Wave action, *Tennessee-Tombigbee *Waterway, *Navigation, *Hydraulic properties, Hydraulic structures, Drawdown, Waves, Wave height.

This investigation evaluated the stability of the in-place riprap on the Tennessee-Tombigbee Waterway and provided limited guidance for design of riprap on other navigable waterways. The in-place riprap was shown to be stable for all tows traveling at speeds up to 80-90% of the theoretical limit speed. Only unloaded tows or service boats, which are capable of traveling near their limit speed, are capable of producing waves high enough to fail the riprap. Water-level drawdown and maximum wave height were measured for a wide range of tow speed and water depth. Greater water depths do not necessarily result in lower wave height or water-level drawdown. Tows simply go faster in the greater water depths, which prevents reduction of wave height or water-level drawdown. Two techniques relating riprap size to wave height were verified in this investigation. Several techniques relating ship speed to maximum wave height were evaluated with the measured data. (Author's abstract)
W87-03317

TUNNELS: MACHINE EXCAVATION - RATE OF PROGRESS - MACHINE DATA,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
R. S. Sinha.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB86-239860, A03 in paper copy, A01 in microfiche. Report No. REC-ERC-86-8, July 1986. 37 p.

Descriptors: *Tunnels, *Hydraulic machinery, *Machine data, *Rocks, *Rapid excavation, Boring, Shale, Sandstone, Conglomerates, Quartzite, Limestone, Siltstone, Granite, Gneiss, Compressive strength.

Information on 20 machine-bored water tunnels constructed by the Bureau of Reclamation is presented graphically and pictorially. Machine data, rates of progress, tunnel profiles, and rock types and strengths are given for each tunnel. The bored diameters of these tunnels varied from 9 to 21 feet. Rocks encountered in boring were: shale, sandstone, conglomerate, quartzite, limestone, siltstone, granite porphyry, granite gneiss, gneissic granodiorite, rhyolite, rhyodacite, and agglomerate. The compressive strengths of these rocks were 300 to 38,000 psi. The boring rates of the machines used varied from 17 to 107 feet for the average calendar day. The maximum progress was 403 feet in 1 three-shift day. This rate was attained in 17.3 hours of machine time while boring an 8-foot 7-inch finished diameter tunnel through shale having a maximum compressive strength of 6,000 psi. Contract and miscellaneous data are also given for each of the tunnels. (Author's abstract)
W87-03320

FLOODPLAIN MANAGEMENT HANDBOOK.
Flood Loss Reduction Associates, Palo Alto, CA.
For primary bibliographic entry see Field 6F.
W87-03330

8B. Hydraulics

RECENT ADVANCES IN THE COMPUTATION OF NONLINEAR WAVE EFFECTS ON OFFSHORE STRUCTURES,
British Columbia Univ., Vancouver. Dept. of Civil Engineering.
M. Isaacson De S. Q.
Canadian Journal of Civil Engineering CJCEB, Vol. 12, No. 3, p 439-453, September 1985. 7 fig, 1 tab, 74 ref.

Descriptors: *Offshore platforms, *Hydrodynamics, *Ocean waves, Flow around objects, Non-

uniform flow, Design, Physical models, Propagation, Morison equations.

Recent research on various nonlinearities that arise in ocean wave interactions with off-shore structures is reviewed. These include nonlinearities associated with the incident waves alone, the response of slender structural members to waves, and the nonlinearities involving wave interactions with large structures. Two nonlinear problems are included: one concerns an investigation into alternative approximations to the Morison equation for flexible structures, and the other concerns the numerical simulation of non-linear wave diffraction around large structures. (Author's abstract)
W87-02668

EXPERIMENTS ON VERTICAL PLANE BUOYANT JETS IN SHALLOW WATER,
Karlsruhe Univ. (Germany, F.R.). Inst. fuer Hydromechanik.
J. Andreopoulos, A. Praturi, and W. Rodi.
Journal of Fluid Mechanics JFLSA7, Vol. 168, p 305-336, July 1986. 23 fig, 1 tab, 22 ref, append.

Descriptors: *Flow measurement, *Shallow water, *Jets, *Buoyancy, *Hydraulics, Flow, Temperature, Physical properties, Hydraulic jump, Hydraulic properties, Weirs, Turbulent flow.

Measurements of the flow generated by a plane buoyant jet discharging vertically into shallow water are reported. Both stable and unstable situations were investigated, the limiting case of a non-buoyant jet representing the unstable one. Most experiments were carried out at a depth-to-discharge-width ratio of 100. In each case, a thick upper layer of nearly uniform temperature developed, with a larger layer thickness for F (Froude number) = 21. Below this layer was a relatively thin interface with temperature gradients and below this a counterflow of cold ambient water. For both Froude numbers, the flow was stable, but only marginally so in the higher-Froude-number case. The observed trends of the flow behavior follow the previously determined stability analysis, but the dilution of the heated water, which was determined from the temperature measurements, is different from that predicted. The dilution is much lower in the case of a flooded jump than in previous analyses with no flooded jump. (Doria-PTT)
W87-02762

ANALYSIS OF THE VELOCITY FIELD IN A BOUNDARY LAYER GENERATED BY A WATER WAVE, (ANALYSE DU CHAMP DES VITESSES DANS LA COUCHE LIMITE GENEREE PAR UNE ONDE PROGRESSIVE (HOULE)),
Le Harve Univ. (France). Lab. de Mecanique des Fluides.
J. Le Bas, and M. Belorgey.
Comptes Rendus de l'Academie des Sciences (Series 2) CHDCAQ, Vol. 303, No. 5, p 323-328, July 1986. 5 fig, 11 ref.

Descriptors: *Flow measurement, *Flow rates, *Velocity, *Boundary layers, *Waves, *Turbulent flow, *Hydrodynamics, Flow, Flow characteristics, Hydrology, Shear stress, Stress.

An instantaneous measurement of velocities can be made by Doppler laser velocimetry without disturbing flow. This has been adapted to the case of an orbital movement and used to study the boundary layer generated by the swell on the bottom of a wave flume. Results show the turbulent character of this boundary layer, even for low Reynold's numbers, permitting the analysis of the evolution of the shear stress on the wall according to the swell phasis. (Author's abstract)
W87-02790

MODIFIED DIFFUSION EQUATION FOR FLOOD PROPAGATION IN TRAPEZOIDAL CHANNELS,
Kentucky Univ., Lexington. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W87-02855

STABILITY OF FLOWS IN CHANNELS WITH SMALL WALL CURVATURE,
Topexpress Ltd., Cambridge (England).
G. A. Georgiou, and P. M. Eagles.
Journal of Fluid Mechanics JFLSA7, Vol. 159, p 259-287, October 1985. 19 fig, 5 tab, 21 ref.

Descriptors: *Channel hydraulics, *Channelflow, *Stability analysis, *Channel morphology, *Flow characteristics, Fluid mechanics, Morphology, Flow, channels, Mathematical studies.

The stability of flows in symmetric curved-walled channels is investigated by combining Fraenkel's 'small' wall-curvature theory, with the multiple scaling (WKB) method. The basic flow is characterized by the steady-state stream function. An infinitesimal disturbance is superimposed on the basic flow through a time-dependent stream function. Two classes of channels are considered. In the first, the curvature is constant in sign, and under certain conditions they reduce to symmetric divergent straight-walled channels. In the second class of channels, the curvature varies in sign, and these may be more suitable for experimentation. A spatially dependent growth rate of the disturbance relative to the basic flow forms the basis of the 'stability' analysis. Critical Reynolds numbers are deduced, below which the disturbance decays as it travels downstream, and above which the disturbance grows for a limited range in the streamwise direction. For the first class of channels, the stability analysis is carried out locally, and the dependence of the critical Reynolds numbers on curvature and high-order terms is investigated. For the second class of channels, the stability analysis is performed at various positions downstream, and an overall minimum critical Reynolds number is predicted for a range of channels and flows. (Author's abstract)
W87-02863

STABILITY CRITERION OF A LAMINAR FLOW,
O. M. Aivazyan.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 12, p 661-671, December 1985. 4 fig, 1 tab, 18 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 12, p 21-27, December 1985.

Descriptors: *Stability analysis, *Mathematical studies, *Laminar flow, *Pipe flow, *Flow characteristics, *Hydraulic engineering, Flow, Fluid mechanics, Pipes, Water transport, Hydraulics, Resistance, Roughness coefficient, Hydrodynamics.

Roughness affects the hydraulic resistance coefficient for flow in pipes in the entire laminar region. Existing equations and other theoretical relations of laminar flow in pipes are valid only for smooth pipes. The lower critical value of the Reynolds number varies greatly depending on the pipe roughness. It is generally accepted that the value is not universal, and is valid only for smooth pipes. An energy criterion was established, the lower critical value of which (just as the lower critical values of its modifications which determine the moment of the loss of stability by laminar flow) are universal for pipes with a variety of roughness. (Doria-PTT)
W87-02868

HYDRAULICS OF RECTANGULAR CLARIFIERS,
Massachusetts Univ., Amherst. Dept. of Civil Engineering.
D. W. Ostendorf.
Journal of Environmental Engineering (ASCE) JOEEDU, Vol. 112, No. 5, 939-952, October 1986. 5 fig, 3 tab, 23 ref, append.

Descriptors: *Hydraulics, *Water treatment, *Clarifiers, Flow, Velocity, Turbulence, Sediments, Advection, Diffusion, Resuspension, Design, Numerical analysis, Velocity profiles, Mathematical models.

A simple model of the steady, two-dimensional water flow through rectangular clarifiers is derived in the absence of wind and stratification. The water flow, or hydraulics, consists of steady velocity and turbulence intensity, and both properties are considered in the analysis. The inlet, settling, and outlet zones are marked by turbulent jet, uniform, and converging flow fields, respectively. Existing analytical solutions and turbulent jet data are invoked to generate a composite, independently calibrated set of velocity profiles that compare favorably with data from clarifier studies. The depth-averaged turbulence intensity is an integral part of the present model and is shown to be generated by the inlet jet flow rather than bottom and wall friction. The intensity governs sediment resuspension in accordance with the Shields criterion for fine sediment, which is cast into a useful constraint on the clarifier geometry. (Author's abstract)
W87-02886

DIRECT SOLUTIONS FOR NORMAL DEPTH USING THE MANNING EQUATION,
University of Strathclyde, Glasgow (Scotland). Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W87-02963

DESIGNING INTAKES TO AVOID FREE-SURFACE VORTICES,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
J. S. Gulliver, A. J. Rindels, and K. C. Lindblom.
International Water Power and Dam Construction IWPCDM, Vol. 38, No. 9, p 24-28, September 1986. 4 fig, 25 ref.

Descriptors: *Free surface vortices, *Hydraulic models, *Intakes, Dye core vortices, Froude number, Turbines, Penstocks, Reynolds number, Antivortex devices, Air core vortices.

Parameters influencing free surface vortices and hydraulic model studies are discussed, and two cases of intake design to eliminate free-surface vortices are described to illustrate antivortex devices. The intake submergence required to avoid free-surface vortices depends on intake diameter, approach flow angle, the dimensions of the structure near the intake, and intake Froude number. Dye core vortices (visually represented by a coherent swirl near the intake), and those of greater strength (trash pulling or air core vortices) should be avoided at hydro plant intakes because of the potential adverse effect on turbine performance. A long penstock (e.g., 150 diameters long), however, will eliminate the swirl through wall friction. The dimensionless circulation parameter is primarily a function of intake geometry and flow approach angle. Thus, Froude-scaled models will accurately represent the phenomena if the intake Reynolds number is sufficiently large. (Rochester-PTT)
W87-03034

BED FRICTION AND DISSIPATION IN A COMBINED CURRENT AND WAVE MOTION,
Technical Univ. of Denmark, Lyngby. Lab. of Applied Mathematical Physics.
J. B. Christoffersen, and I. G. Jonsson.
Ocean Engineering OCENBQ, Vol. 12, No. 5, p 387-423, 1985. 12 fig, 3 tab, 34 ref, append.

Descriptors: *Friction, *Water currents, *Ocean currents, *Dissipation, *Wave action, Kinematics, Viscosity, Eddies, Boundary layers, Wave velocity, Shear stress, Model studies.

Two simple two-layer eddy viscosity models, which facilitate analytical solutions, are presented in order to describe the velocity field and associated shear stress in a combined current wave motion. The models, which have the same eddy viscosity in the current boundary layer, but different eddy viscosities in the wave boundary layer, cover together the whole rough turbulent regime. Straightforward definitions are made for the wave friction factor and the current friction factor for the combined motion, which are in accordance with the results for pure waves and pure currents. In this way, one avoids the fictitious reference velocities and elliptic integrals which have been previously experienced. The two friction factors turn out to

be functions of four dimensionless parameters. A detailed calculation procedure is presented. Comparison with laboratory experiments yields promising results. A new relation connecting dissipation and bed shear stress is also developed. (Author's abstract)
W87-03210

COMPUTATION OF WAVE TRANSMISSION OVER A SHORE PROTECTING SUBMERGED BREAKWATER,
Cochin Univ. (India). Dept. of Marine Sciences.
M. Baba.
Ocean Engineering OCENBQ, Vol. 13, No. 3, p 227-237, 1986. 8 fig, 31 ref.

Descriptors: *Wave runup, *Wave transmission, *Breakwaters, *Mathematical analysis, *Coastal engineering, Mathematical equations, Wave reflection, Waves, Coastal waters, Wave height, Beaches.

Offshore breakwaters, both subaerial and submerged, are generally used to advance breaking of waves to protect harbor and other coastal installations. The most important criterion for their design in such cases is a minimum transmission coefficient. Lately, these structures are finding their way into shore stabilization and coastal protection projects. The basic function of a breakwater in these cases is to stop the high-steep eroding type of waves and to allow only those waves which help the accretion of the beach. Among these offshore breakwaters, a bevelled block submerged breakwater, with 1 on 1.67 seaward slope, and a vertical shoreward face, is most advantageous, especially from the point of view of optimum wave damping, minimum wave reflection, and maximum sand trapping. Different computational methods of wave transmission coefficient of this breakwater were studied using laboratory wave flumes. Goda's method was found to be the simplest and most suitable method, especially in the case of shore-protecting submerged breakwaters. (Lantz-PTT)
W87-03217

SPECTRAL AND STATISTICAL CHARACTERISTICS OF SHALLOW WATER WAVES,
Centre for Earth Science Studies, Cochin (India).
C. M. Harish, and M. Baba.
Ocean Engineering OCENBQ, Vol. 13, No. 3, p 239-248, 1986. 4 fig, 4 tab, 27 ref.

Descriptors: *Mathematical analysis, *Waves, *Shallow water, *Wave height, Statistical methods, Mathematical studies, Tucker method, Frequency analysis, Wave velocity, Wave propagation.

Simple methods, based on statistical theories, or wave-by-wave analysis, have generally been employed to derive the wave characteristics from wave records in the time domain. The state-of-the-art demands examination of the problem in the frequency domain, the most satisfactory procedure being energy spectrum analysis. While wave-by-wave analysis reveals the non-linearity of the phenomena, the spectral method throws light into the irregularities of the same. In this study, spectral, zero up-crossing and Tucker's methods of analysis are examined for shallow water wave records. Among the wave height parameters H sub s (the average height of the highest one-third zero up-crossing waves) and H' (average height of zero up-crossing waves) are most reliable and consistent irrespective of the analysis technique. Tucker analysis, thought simple, seems versatile for estimating these wave height parameters. The standard period parameters are less consistent. For practical purposes every period that might reasonably occur has to be considered along with their corresponding height estimate. Joint distribution of heights and periods is in agreement with the function proposed by CNEXO. (Lantz-PTT)
W87-03218

PROCEEDINGS: CE WORKSHOP ON DESIGN AND OPERATION OF SELECTIVE WITHDRAWAL INTAKE STRUCTURES.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8A.
W87-03221

SELECTIVE WITHDRAWAL: BASIC CONCEPTS,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
S. C. Wilhelms.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 13-18, 4 fig, 7 ref.

Descriptors: *Selective withdrawal, *Water quality control, *Statistical flow forecasting, Stratification, Mathematical equations, Hydraulic models, Mathematical models, SELECT, Dissolved oxygen, Hydrogen ion concentration, Conductivity, Iron, Manganese, Dissolved solids.

An intuitive approach is used to explain the stratified flow phenomenon known as selective withdrawal. Basic definitions and descriptions are given for the geometries, stratification conditions, and other processes that impact the selective withdrawal characteristics of ports and weirs. Equations that describe the establishment of a withdrawal zone are presented for various density stratifications. The basis for the numerical predictive model SELECT is presented. Given the temperature or density profile of a reservoir, the outlet geometry (port or weir), and discharge, SELECT can predict the limits of withdrawal, the distribution flow between the limits, and the release temperature. In addition to estimating release temperature, SELECT can predict the release concentration of any in-lake water quality parameter such as dissolved oxygen, pH, conductivity, iron, manganese, and suspended or dissolved solids. Given the vertical distribution of the water quality parameter, SELECT superimposes the withdrawal distribution on the quality profile. The withdrawal-weighted release concentration or value can then be calculated. (See also W87-03221) (Lantz-PTT)
W87-03222

DESIGN OF SELECTIVE WITHDRAWAL INTAKE STRUCTURES,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8A.
W87-03237

FIELD MEASUREMENTS AT INTAKE STRUCTURES,
Army Engineer Waterways Experiment Station, Vicksburg, MS.
E. D. Hart.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 116-122, 5 fig, 3 ref.

Descriptors: *Field tests, *Intakes, *Structures, *Water quality control, Beltzville Dam, Pennsylvania, Dissolved oxygen, Temperature, Outlets, Flow rates, Intakes, Taylorsville Dam, Kentucky.

Prototype water-quality tests were conducted at Beltzville Dam in Pennsylvania. The purpose was to determine the location and degree of reaeration of flow that occurred as it passed through the outlet works. Temperature and dissolved oxygen data were collected in the reservoir, at seven stations within the outlet structure, and in the downstream channel. The tests involved various flow rates and intake levels. Similar measurements are scheduled to be conducted at Taylorsville Dam, Kentucky in the summer of 1985. In addition, because of the unique intake tower trash rack design, inlet velocities will be measured for determining entering velocity profiles. (See also W87-03221) (Author's abstract)
W87-03240

THOUGHTS AND CONSIDERATIONS FOR HYDRAULIC DESIGN,
T. J. Albrecht.
IN: Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures, June 24-28, 1985, San Francisco, CA. May 1986. p 123-139, 14 fig.

Descriptors: *Hydraulic design, *Hydraulic structures, *Outlets, *Selective withdrawal, Flow profiles, Water quality control, Dissolved oxygen, Fisheries, Turbidity, Inlet wells, Discharge capacity, Gates, Valves.

Starting in the early 1950's, a few projects had facilities included in their outlets to permit releases in the summer months from their upper conservation pool levels. These facilities were generally sized to pass very small (and usually arbitrarily selected) flows. The purposes that were usually given for these facilities were: to release warm water for downstream fisheries, to obtain higher dissolved oxygen levels in the tailwater, and/or to reduce chemical or turbidity concentrations. Analysis was limited to that necessary to define the discharge capacity. In the early 1960's, the push for including facilities that would permit release of larger flows from any of several levels in the reservoir really got going. This presentation focuses on three of the more common problems in the hydraulic design of a selective withdrawal structure: should it have one or two wet wells, setting the discharge capacity of the ports and/or wet wells, and using and selecting commercially available gates and valves. Both existing and planned projects will be utilized to illustrate specific features, problems, and alternatives. (See also W87-03221) (Lantz-PTT)
W87-03241

DESIGN AND PERFORMANCE OF SKIMMING WEIRS IN THE KANSAS CITY DISTRICT,
Corps of Engineers, Kansas City, MO. Kansas City District.
For primary bibliographic entry see Field 8A.
W87-03247

FLOW PROCESSES OF A CUTTERHEAD DREDGE,
Slotta Engineering Associates, Inc., Corvallis, OR.
For primary bibliographic entry see Field 8C.
W87-03262

RIPRAP STABILITY AND NAVIGATION TESTS FOR THE DIVIDE-CUT SECTION TENNESSEE-TOMBIGBEE WATERWAY,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8A.
W87-03317

LOCK AND DAM 1, RED RIVER WATERWAY: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
J. E. Foster, C. R. O'Dell, and J. E. Glover.
Available from the National Technical Information Service, Springfield, VA. 22161 as AD-A171594, A06 in paper copy, A01 in microfiche. Technical Report HL-86-6, June 1986. Final Report. 109 p, 14 fig, 5 tab.

Descriptors: *Dams, *Locks, *Red River, *Hydraulic models, Model studies, Channels, Channel flow, Hydraulic properties, Rivers, River flow, Currents.

A model reproducing two reaches of the Red River from 1967 river mile 52.0 to 49.8 and from mile 44.0 to 41.5 and the proposed cutoff connecting these two reaches, including Lock and Dam 1, was built for this study. The model was built with provision to mold the channel bed either in pea rock to an undistorted scale of 1:120 for navigation tests so velocities and current directions could be taken or in crushed coal to a distorted scale of 1:120 horizontally and 1:80 vertically for channel development tests to study bed configuration changes. The model study was conducted to determine navigation conditions and channel develop-

ments to be expected from the original design and to develop modifications that might be required to: (a) improve flow conditions that would be adverse to navigation, and (b) minimize the dredging required to maintain a channel of satisfactory dimensions along a designed alignment. Results of the investigation revealed the following: (1) a navigation channel of adequate width and depth could be developed with Lock and Dam 1 located at the proposed site with the modifications developed in Plan B-34; (2) little or no maintenance dredging of bed load should be required except after sustained high water occurs with extremely low tailwater conditions; (3) the channel should remain satisfactory with the proposed mooring facility constructed downstream of the local as in plan B-35; (4) downbound tows would need to cross to the left side of the channel just upstream of the longitudinal dike, stay along the left side, and maintain speed until they are out of the main channel; and (5) the difference in water-surface elevation across the dam with open river conditions was between 0.1 ft and 0.3 ft for the flows tested. (Lantz-PTT)
W87-03333

BURLINGTON SPILLWAY AND OUTLET WORKS SOURIS RIVER, NORTH DAKOTA: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
J. V. Markussen, and N. R. Oswalt.
Available from the National Technical Information Service, Springfield, VA. 22161 as AD-A171752, A04 in paper copy, A01 in microfiche. Technical Report HL-86-4, June 1986. Final Report. 55 p, 2 fig.

Descriptors: *Spillways, *Outlets, *Souris River, *North Dakota, *Hydraulic models, Model studies, Flood control, Hydraulic properties, Flow profiles, Stilling basins, Water quality control, Mathematical studies, Flow measurement, Flow rates.

Two separate physical hydraulic model investigations concerning the proposed Burlington flood-control project are reported. The first is a 1:80-scale general model of the spillway and outlet works with stilling basins and common embankment to verify the adequacy of design and to develop necessary modifications. The second study used a 1:25-scale outlet works model to allow detailed evaluation and modification of various outlet works components. Significant modifications were made to both the spillway and outlet works during these investigations to improve approach flows, improve spillway efficiency, and eliminate a vortex during combined spillway and outlet works operation. The original exit channel alignment was found to remain stable and perform satisfactorily for the range of expected operating conditions. The stilling basin sidewalls for the spillway and outlet works were raised to el 1589 so that the adjacent backfill areas would remain dry. The discharge capacity of the spillway was found to be 60,525 cfs for the design head of 25 ft, with the tainter gate trunnions remaining above the water surface for the range of expected operating conditions. The discharge capacity of the flood-control facility for the outlet works was determined to be approximately 25,300 cfs for the design head on the center of the gate of 62.5 ft. Four flow regimes were identified for the flood-control facility and found to be a function of the gate opening and/or tailwater. The water quality withdrawal facility was found to have three operating regimes depending on the gate opening. The greater range of flow control was provided when operating with the aperture at the minimum elevation of 1592. The stilling basins for the spillway and outlet works performed satisfactorily for the range of expected operating conditions. (Lantz-PTT)
W87-03334

MILL CREEK CHANNEL, WALLA WALLA, WASHINGTON: HYDRAULIC MODEL INVESTIGATION,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
D. W. Robinson, and R. R. Copeland.
Available from the National Technical Information Service, Springfield, VA. 22161 as AD-A169608, A05 in paper copy, A01 in microfiche. Technical Report HL-86-2, May 1986. Final Report. 79 p, 15 fig, 6 ref.

Descriptors: *Mill Creek Channel, *Walla Walla, *Washington, *Hydraulic models, Scour, Gravel, Mathematical studies, Mathematical equations, Stability analysis, Riprap, Stable channels, Channels, Channel flow, Flow.

A physical model can be used to quantitatively design local scour protection in a gravel-bed stream where a sufficient portion of the bed material is coarse enough to be simulated according to the Froudian criteria. In this study, the coarser 70% of the bed material was scaled appropriately. The finer material, when unprotected by an armor layer, was transported out of the model much as it would be in the natural stream. Existing methods available for calculating scour depths downstream from low sills (Schoklitsch, Eggenberger, Mueller and Veronese) proved inadequate for Mill Creek. Concrete-capped stabilizers with sloping riprap aprons can be used successfully to stabilize Mill Creek channel for a unit discharge of 50 cfc/ft. The bed material of Mill Creek is composed of sand and gravel with a D-50 of 22 mm, and is generally armored with gravels. The maximum channel slope tested for Mill Creek was 0.016. Stabilizers are 60 to 70 ft apart. The apron developed as a result of the model study was composed of riprap with a W-50 of 200 lb and on a slope of 1V on 3.1H. The top of the apron was located 2.5 ft below the top of the stabilizer. The apron's horizontal length was 8 ft. The banks were protected with the same size riprap placed on a 1V-on-2H slope. The top of the riprap was 2 ft above the top of the stabilizer. Toe protection was provided with a 9-ft-long and 3-ft-thick horizontal apron, the top of which was equal to the top of the stabilizers. With this recommended design, scour depths of about 5.3 ft can be expected in Mill Creek with the design discharge of 3,500 cfs. Sheet-pile stabilizers with riprap protection upstream and downstream may also be used to stabilize Mill Creek channel for a unit discharge of 50 cfs/ft. The maximum slope tested for this type of stabilizer was 0.013. (Lantz-PTT)
W87-03335

8C. Hydraulic Machinery

SMALL POWER STATIONS ABROAD, (ASPECTS SPECIFIQUES DE MINICENTRALES A L'ETRANGER),
ITH, Castelnau-le-Lez (France).
A. Tranain.
La Houille Blanche, No. 1/2, p 35-38, 1986. 1 fig.

Descriptors: *Hydroelectric plants, *Gabon, *Nepal, *Portugal, Dams, Hydraulic equipment, Powerplants, Developing countries.

Small hydroelectric powerplants are now being operated abroad, either as an energy-saving measure, selling the power generated to the public distribution network (as in developed countries such as Portugal), or to provide electric power to distant rural centers by a separate network (developing countries such as Nepal and Gabon are examples). In the first case, the aim is to make the most of an available energy resource: the typical equipment of one of many dams in Portugal is described as an example. The power station in this case was estimated to be capable of 515,000 kwh/year, most of which would be generated during the winter high-water period. In the case of developing countries, satisfaction of local needs guides the selection of equipment. In conclusion, hydraulic power remains a choice resource from an engineering standpoint. However, in all disciplines, the search for minimal costs should be emphasized, due to the increasing competitiveness of other rapidly-developing means of the generation of electricity. (Airone-PTT)
W87-02566

FEW DATA ABOUT INDEPENDENT PRODUCERS OF HYDROELECTRICITY IN FRANCE, (QUELQUES DONNEES SUR LA PRODUCTION HYDROELECTRIQUE AUTONOME EN FRANCE),
Electricite de France, Paris. Direction de l'Equipement.
J. Rabaud, and J. P. Catalan.
La Houille Blanche, No. 1/2, p 39-46, 1986. 8 fig, 2 tab, 4 ref.

Descriptors: *Electric power production, *France, *Data collections, Surface water, Energy sources, Resource management, Hydroelectric power.

Electricite de France made a survey to include the independent power-generating stations connected to the power system in its Gravity Hydraulic Inventory of France. Statistics drawn up from this survey include: geographic distribution by number and power, years of operation, generating capacity and rated powers. The Tarn Department has the most power plants (73) but the Ariege Department has the highest power generating capacity (38 MW). The total for France is 1034 power plants and 567 MW. The Midi-Pyrenees region is the leading region with 259 power plants and 176 MW. The survey was conducted in 1983. (Author's abstract)
W87-02567

TAKING HYDROLOGY AND ECONOMIC FACTORS INTO ACCOUNT FOR CALCULATING THE ECONOMIC DIAMETER OF THE PENSTOCKS FOR HIGH HEAD MICROPOWER PLANTS, (PRISE EN COMPTE DE L'HYDROLOGIE ET DES FACTEURS ECONOMIQUES DANS LE CALCUL DU DIAMETRE ECONOMIQUE DES CONDUITES FORCEES DES MICROCENTRALES HAUTE CHUTE),
Societe Grenobloise d'Etudes et d'Applications Hydrauliques (France).
Th. Bongrand.
La Houille Blanche, No. 1/2, p 47-54, 1986.

Descriptors: *Mathematical equations, *Economic feasibility, *Penstocks, *Power head, Electric power costs, Hydroelectric plants, Hydrology, Powerplants.

The economical diameter of the draft tubes for high head power stations is often determined from simplified equations (Sarkaria, Fahlbusch, Bresse, etc.) the results of which diverge increasingly as the diameter decreases (case of small power stations). Certain equations, such as Sarkaria's, do not allow economic factors to be taken into account, which raises the problem of their validity. In addition, for small flows, this is certain to lead to unacceptable results. The computation from which the above simplified equations are derived in order to arrive at a complete equation taking into account both hydrology and the prevailing economic factors is given. The complete equation (which can prove complex to use) is employed in a HP 9845 microcomputer program which, in addition to determining the economical diameters of the line, also establishes the generating capacity for the site. The microplant at Venosc-Alpes is used as an example. (Author's abstract)
W87-02568

CREATION OF A CROSS-FLOW TURBINES RANGE, (CREATION D'UNE GAMME DE TURBINES A FLUX TRAVERSANT),
Leroy-Somer, Angouleme (France).
B. Cheriere.
La Houille Blanche, No. 1/2, p 55-62, 1986. 10 fig.

Descriptors: *Hydroelectric plants, *Power head, *Turbines, *Construction costs, *Developing countries, Powerplants, Energy sources, Technology, Water yield improvement, Mathematical studies.

It is necessary to standardize small hydroelectric powerplants in order to achieve advantageous costs and prices. Simplicity of equipment is an important asset for major export. A cross-flow turbine which satisfies these requirements for medium (5 to 100 m) heads is described. The test results obtained on a model and the basic working data for design of a family are given. The model

incorporates a new type of flow regulator (chopping-gate type) which results in reduced cavitation and more efficient use of partial draw. The proposed turbine design achieves simplicity of installation and requires maintenance equivalent to a Pelton. This makes it appropriate for low-technology sites, particularly in third-world countries seeking to construct low-power (20 to 1000 kW) facilities for local use. (Airone-PTT)
W87-02569

ECONOMY AND PERFORMANCE OF SMALL TURBINES, (ECONOMIE ET PERFORMANCE DES PETITES TURBINES),
Neyrpic, Grenoble (France). Dept. Petites Centrales.
G. Picollier, and P. Girault.
La Houille Blanche, No. 1/2, p 63-73, 1986. 8 fig, 5 ref.

Descriptors: *Electric power costs, *Developing countries, *Powerplants, *Turbines, *Optimization, Cost analysis, Model studies, Economic aspects, Hydroelectric power.

The parameters involved in the economic plan of a small hydroelectric plant, focussing on the turbine are examined. The selection criteria are a function of the site power generation and consumption potential. Optimization of the cost/generation capacity ratio is a trade-off involving technical sophistication, quality, lead times, reliability, and service. For low power, the efficiency of certain plants is not assured. Therefore, for the same hydraulic characteristics, a manufacturer will propose a more or less sophisticated machine, performing more or less in accord with the final aim of the project. Given the current financial strictures, particularly in the hydroelectric field, it is incumbent on all parties concerned to limit costs. Several suggested cost-cutting measures include: less rigid contract requirements, allowing the builder to exercise greater judgment, and the use of results from laboratory tests which all parties have agreed to (this is less costly than construction and testing of a small-scale model). (Airone-PTT)
W87-02570

SMALL HYDROELECTRIC POWER PLANTS FOR VERY LOW HEADS, (LES USINES DE TRES BASSE CHUTE EN MINI-HYDROELECTRICITE),
Energies S.A., Paris (France).
A. Argenson.
La Houille Blanche, No. 1/2, p 75-78, 1986. 2 fig, 3 tab.

Descriptors: *Hydroelectric plants, *Siphon effect, *Turbines, *Power head, Powerplants, Energy sources.

Experience in designing, building and operating more than ten hydroelectric powerplants with a maximum raw head less than 5 m, and containing 2 or 3 turbines is described. The common feature in these plants is use of the siphon phenomenon with Kaplan turbines in two specific arrangements: vertical turbine with downflow, and vertical turbine with upflow, the so-called reverse siphon. Both types are exemplified with data from existing facilities in which one configuration or the other has been established: Meymes and Decize (downflow), and La Rocque Bouillac (upflow). (Airone-PTT)
W87-02571

PROBLEMS ENCOUNTERED IN THE OPERATION OF SMALL POWER PLANTS, (PROBLEMES RENCONTRES A LA MISE EN SERVICE DE MICROCENTRALES),
J. Blanc, and M. Tuillier.
La Houille Blanche, No. 1/2, p 79-85, 1986.

Descriptors: *Powerplants, *Costs, *Hydraulic machinery, *France, *Provence, Hydroelectric power, Project planning.

The Societe du Canal de Provence has been operating two small powerplants on this artificial waterway since 1984. A number of problems have arisen since they were placed in service: cavitation in the impeller of a Francis turbine, operation of a motor as generator with damage to the thrust bearings, fault on Electricite de France transmission line, adjustment of the action of the guide vane governor (frequency and duration), sticking of the downstream valve. These problems have been partially corrected and allow the efficiency in time of a small power station to be measured during the semi-industrial operating period. These results can be extrapolated to the industrial operating period. (Author's abstract)
W87-02572

SMALL HYDROELECTRIC PLANTS AND ENVIRONEMENTAL PROTECTION, (PETITE HYDRAULIQUE ET PROTECTION DE L'ENVIRONMENT),
J. P. Henry, and L. Monition.
La Houille Blanche, No. 1/2, p 87-94, 1986. 5 ref.

Descriptors: *Hydroelectric plants, *France, *Powerplants, *Legal aspects, *Environmental protection, *Regulations, Fish, Fish farming, Economic impact, Social impact, Ecosystems, Environmental impact statement.

The environment must be given sufficient consideration when developing small hydroelectric plants. In France, the law relative to the protection of nature (1976) and its application decree relative to impact studies (1977) set the legal framework for evaluating all types of effects of a plant (impact on the watershed, the aquatic ecosystem, the landscape, social and economic impact, etc.) The law also requires considering measures designed to eliminate, reduce, and if possible compensate the litigible consequences of the projects. The recent law relative to fresh water fishing and management of piscicultural resources (June 1984) mentions that conservation of the aquatic environments and protection of the piscicultural resources are of general interest. In this respect it sets forth new obligations concerning reserved flow in the bed of a waterway and passes for fish. A number of such passes are described. In many cases, solutions can be suggested and implemented under technical and financial conditions that are acceptable to the operators and other users of the river and water. (Author's abstract)
W87-02573

ADAPTATION OF AN EXISTING SILL FOR INSTALLATION OF A SIPHON PLANT, (ADAPTATION D'UN SEUIL EXISTANT POUR L'IMPLANTATION D'UN GROUPE EN SIPHON),
Electricite de France, Chambery. Region d'Equipement Alpes-Lyon.
M. Q. M. Truong.
La Houille Blanche, No. 1/2, p 95-101, 1986. 5 fig, 9 ref.

Descriptors: *Construction costs, *Siphons, *Powerplants, Hydroelectric plants, France, Civil engineering, Site selection, Mayenne River.

Among the various modes of installation of turbine-generator plants, siphon plants are probably the simplest and therefore the most economical solution for small hydroelectric powerplants, especially when a fall already exists, thus creating the head. The design of the civil works for such a case is described using as an example the fall on the Mayenne River in the Loire County region. It is concluded that civil engineering costs can be reduced to about 10-15% of the costs of the electromechanical equipment (usually these two sets of costs are of approximately the same magnitude). (Airone-PTT)
W87-02574

ENERGY RECOVERY SMALL HYDRO PLANTS ON THE RHONE RIVER. THE FIRST MONTHS OF OPERATION OF CHAMPAGNEUX POWER PLANT AND THE SAULT-BRENAZ PROJECT, (LES PETITES CENTRALES DE RECUPERATION SUR LE RHONE. LES PREMIERS MOIS D' EXPLOITATION DE LA CENTRALE DE CHAMPAGNEUX ET LE PROJECT DE SAULT-BRENAZ),
Compagnie Nationale du Rhone, Lyon (France).
Y. Barbier.
La Houille Blanche, No. 1/2, p 103-108, 1986. 3 fig, 1 tab.

Descriptors: *Rhone River, *Dams, *Champagneux, *Sault-Brenaz, *Water reuse, *France, *Hydroelectric plants, Energy recovery, Abutments, Hydraulic equipment, Energy sources.

Within the framework of hydroelectric development of the Rhone River, the Compagnie nationale du Rhone installs small hydroelectric power plants in the abutment piers of dams to recover part of the energy spilled over with the reserved flow. Seven such plants are in service or are in planning and construction, for a total of 11,065 kW production. The Champagneux dam power plant, equipped with two bulb units, went into operation in November 1984 and has been operating satisfactorily since that time. The choice of unit was left to the initiative of the manufacturer in the case of the Sault-Brenaz project, allowing the most suitable machine to be selected. The planning history, equipment, and some minor technical problems of these two plants are briefly discussed. (Airone-PTT)
W87-02575

STANDARDIZED DESIGN AND UNITS FOR SMALL HYDROPROJECTS 10 TO 20 M HEAD, (PROJETS ET MATERIELS STANDARDS POUR PETITS AMENAGEMENTS HYDRAULIQUES DE 10 A 20 M DE CHUTE),
M. Bassereau.
La Houille Blanche, No. 1/2, p 109-117, 1986. 12 fig.

Descriptors: *Powerplants, *Hydroelectric power, *Hydraulic equipment, Standardization, Economies of scale.

The standard arrangements adopted to equip a number of falls with similar characteristics (average H = 15 m, Q = 15 cu m/s) are described. Included are: the multiple-arch buttress dam (between buttresses, the plants are installed in cells located under the spillway), plants with hydraulic S lines (with a Kaplan turbine and an off-line generator located upstream equipped with a downstream valve), and control equipment based on industrial programmable controllers. The falls on the Age and Champsanglard (the Creuse) presently operate on this basis. Performance characteristics are given based on results from on-site tests of the group performed by Electricite de France. (Airone-PTT)
W87-02576

WATER-HAMMER DIAGNOSTIC ESTABLISHED BY A NUMERICAL METHOD, (UN DIAGNOSTIC DE COUP DE BELIER ETABLI PAR MODELE NUMERIQUE),
A. Carron.
La Houille Blanche, No. 1/2, p 119-126, 1986. 7 fig.

Descriptors: *Water hammer, *Water mains, *Sri Lanka, *Computer models, *Cebel model, *Accidents, Hammering protection, Water supply systems, Mathematical models, Pump testing.

During initial water testing of the Trincomalee water main of Sri Lanka, serious damage occurred due to very high excess pressure subsequent to stopping of the pumps: rupture of a seal, flooding of the pump station, displacement of the pumping units. The Societe du Canal de Provence which designed the hammering protection system (hydropneumatic balloon associated with a perforated valve) was invited to make an evaluation and advise on corrective action. After analyzing the effect of initial volume of air in the balloon and the pressure loss coefficient on the maximum pressure subsequent to stopping of the pumps, using the Cebel numerical model, and after scale model measurements of the pressure loss coefficient of the perforated valve, it appeared that the cause of the excess pressure observed was due to perforation of the flapper not in compliance with the initial speci-

fications. Pressure recordings made after modifying the valve made it possible to check the pressure loss coefficient of the valve in location and the pressure variation amplitude subsequent to stopping of the pumps. The values obtained were in agreement with the computation. (Author's abstract)
W87-02577

OVERPRESSURE PEAK IN DUAL HORIZONTAL FRANCIS TURBINES: INDUSTRIAL EXPERIMENTS RESULTS, (PIC DE SURPRESSION DES FRANCIS HORIZONTALES DOUBLES: RESULTATS D'EXPERIENCES INDUSTRIELLES),
Neyrpic, Grenoble (France).
J. P. Taulan.
La Houille Blanche, No. 1/2, p 127-135, 1986. 3 fig, 8 ref.

Descriptors: *Turbines, *Overpressure, *Hydraulic equipment, Simulation analysis, Water hammer, France.

During initiation, certain horizontal Francis turbines exhibit an over-pressure peak, a sudden increase in upstream pressure when the conventional hammer seems completed. Tests at Monistrol d'Allier were analyzed in an attempt to explain this singularity by the presence of an S shape beyond the zero torque in the Q11 (n11) characteristic of the turbine. Simulation on a computer taking the S into account and introducing a very slight asymmetry between the two runners leads to a variation in the upstream pressure comparable to that observed during tests. Recently, commissioning of Ocana and Tolla shed new light and allowed a new analysis: in particular, the influence of the design of the runner and the gap between the blades and the guide vanes is considered, as is the influence of the theta/tau ratio, i.e. the time of initiation of operation to the time of initiation of rotating parts. (Author's abstract)
W87-02578

INFLUENCE OF THE RUNNER BLADE ANGLE VARIATION ON KAPLAN TURBINE TRANSIENTS, (INFLUENCE DE LA VARIATION D'INCLINAISON DES PALES SUR LES REGIMES TRANSITOIRES DES TURBINES KAPLAN),
Electricite de France, Chambery. Region d'Equipement Alpes-Lyon.
P. Huvet.
La Houille Blanche, No. 1/2, p 137-147, 1986. 16 fig, 1 tab, 9 ref.

Descriptors: *Mathematical studies, *Turbines, *Hydraulic equipment, Testing procedures, Powerplants, France, Sluice gates, Propellers.

On the occasion of the commissioning of the Kaplan turbines of Villerest and Oz-en-Oisans, the influence of the variation of the blade angle on the transient states was analyzed by comparing computations and industrial tests. To take into account the movements of the sluice gates and propeller, the reduced characteristics are determined by double interpolation according to the distributor openings and blade angles. The numerical results, in particular the variation in rotation speed, agree well with the test records: for slow blade closing and rapid blade opening, for nominal and partial powers and heads and for different speeds of operation of the distributor. The influence of blade angle variation is therefore not negligible. (Author's abstract)
W87-02579

ANALYSIS OF TRANSIENT PHENOMENA IN HYDROELECTRIC GENERATION PLANTS, (CALCUL DES TRANSITOIRES DANS LES INSTALLATIONS HYDRAULIQUES DE PRODUCTION D'ENERGIE),
Electricite de France, Chambery. Region d'Equipement Alpes-Lyon.
J. F. Calendray, D. Ilhat, J. Planchard, J. F. Lauro, and C. Velo.
La Houille Blanche, No. 1/2, p 149-157, 1986. 10 fig, 13 ref.

Descriptors: *Mathematical models, *Pumping plants, *Computer programs, Belier code, Simulations, Hydraulic equipment, Allievi equations, Turbines, France.

The construction in recent years of a number of pumping power transfer plants and the supplementary equipping of existing systems required Electricite de France to acquire a program to simulate transient states in the most complex systems. The Belier code was developed to calculate pressures and flows at any point of a water system which may include Francis and Pelton turbines, valves, vents, etc. The computation method used is reviewed and a number of plants designed using this program are described. Comparisons with on site measurements are given: rather good agreement was found between calculated and observed values, especially in the cases of the La Coche and Le Cheylas pump facilities. The program's modular construction permitted it to simulate very complex situations. (Airone-PTT)
W87-02580

DELAY OF REACTION TURBINES AND PUMPS TO TRANSIENT STATES, (RETARD DES TURBINES A REACTION ET DES POMPES DANS LEUR COMPORTEMENT EN REGIME TRANSITOIRE),
Electricite de France, Paris. Dept. Technique.
D. Simonnot.
La Houille Blanche, No. 1/2, p 159-168, 1986. 12 fig.

Descriptors: *Mathematical models, *Hydraulic machinery, *Simulations, Mathematical analysis, Transient states, Turbines, Pumps.

In numerical models of transient states of machines, the characteristics of the machines are assumed to be those of steady state operation under prevailing speed and net head conditions. This practice is systematically refuted by confronting measurement and computation: a delay is observed between the real and the predicted theoretical behavior. Three typical examples of this phenomenon, which for practical industrial reasons were subjected to thorough analysis, are: a centrifugal pump in dynamic state; large, rapid fluctuations of power in a Kaplan; and the power transfer function upon opening in a Kaplan. The numerical model was corrected to improve the simulation. (Airone-PTT)
W87-02581

MATERIALS TECHNOLOGY FOR TURBINE PERFORMANCE,
British Columbia Hydro and Power Authority, Vancouver. Metallurgy Section.
A. Akhtar.
Water Power and Dam Construction, Vol. 38, No. 8, p 13-19, August 1986. 4 fig, 34 ref.

Descriptors: *Turbines, *Construction materials, *Hydraulic turbine runners, *Hydroelectric plants, *AOD process, *ESW technique, *Cavitation, *Fatigue cracking, Flowing water, Dams, Power plants, Fatigue limit, Hydraulic equipment.

Pump turbines have been developed to enhance the peak shaving capability of electrical power systems, and, to take advantage of run-of-the-river flow conditions , bulb units and variable pitch Kaplan turbines have been optimized. A survey of the operating experience in the US has shown that hydraulic plants are highly reliable in comparison with thermal plants. Materials technology has played an important role in the fabrication of and maintenence of hydraulic turbines. Cost effectiveness, structural integrity, cavitation erosion resistance and ease of maintenence are the criteria in the choice of materials for the structural components of turbines. The method of fabrication of large hydraulic turbine runners is affected by a number of factors: a high efficiency of energy conversion must be maintained, and ease of transporting the turbines to the installation site must be considered. In choosing materials and the fabrication method, operational reliability must also be taken into account. Present technology in materials and fabrication methods are reviewed and selected case histories are presented. (Alexander-PTT)
W87-02687

LARGE PELTON TURBINES FOR CANADA'S CAT ARM SCHEME,
Sulzer-Escher Wyss Ltd., Zurich (Switzerland).
J. Meier, and B. Jacquet.
Water Power and Dam Construction, Vol. 38, No. 8, p 19-22, August 1986.

Descriptors: *Pelton turbines, *Hydraulic design, *Cost analysis, *Newfoundland, Operation, Mechanical design, Maintenence, Canada, Cat Arm scheme, Dams, Hydraulic design, Hydroelectric plants, Turbines, Hydraulic equipment.

Two high-head Pelton turbines were recently supplied by the Swiss manufacturer Sulzer-Escher Wyss to the Cat Arm hydro plant in northern Newfoundland, Canada. The station was commissioned in May 1985. No major problems have arisen since the plant was put into service. The machines have been used continuously since then with a load factor of nearly 100%. The transient operations, especially the startup and shutdown as well as the running of the machines has been very smooth. The scheduled regular inspections have been carried out and proved satisfactory hydraulic and mechanical behavior. The design of the hydraulic system and the electro-mechanical equipment at the plant are described. (Alexander-PTT)
W87-02688

WATERHAMMER PRESSURE COMPENSATION IN TURBINE REGULATING SYSTEMS,
Electric Power Development Co. Ltd., Tokyo (Japan).
Z. S. Shen, C. G. Zhong, and W. Y. Fu.
Water Power and Dam Construction, Vol. 38, No. 8, p 25-28, August 1986. 9 fig.

Descriptors: *Waterhammer pressure, *Turbines, *Regulating systems, *Penstocks, Field tests, Feedback, Hydroelectric plants, Transformers, Hydraulic equipment.

Simulation and field tests have shown that the quality of turbine regulation can be significantly improved if compensation for the waterhammer pressure is included within the system. The waterhammer pressure feedback signal is derived from the spiral casing and is directed through a transformer converting the pressure into a voltage signal. Simulation work was carried out on analog and digital computers for the purpose of understanding the effect of the waterhammer pressure feedback and choosing the method of the pressure feedback in hydro stations. Field tests were carried out on various power stations that have long penstocks. A simulated compensating circuit proved less expensive to install than a direct waterhammer pressure compensating circuit. The cost of a direct circuit mainly depends on the type of pressure transformer used. It was difficult to relate the waterhammer pressure feedback into a mechanical governor. (Alexander-PTT)
W87-02690

65 MW BULB TURBINE FOR JAPAN'S TADAMI PROJECT,
British Columbia Hydro and Power Authority, Vancouver. Hydroelectric Generation Projects Div.
T. Motoki, H. Inoue, and H. Toshima.
Water Power and Dam Construction, Vol. 38, No. 8, p 33-39, August 1986. 18 fig, 2 tab, 4 ref.

Descriptors: *Bulb turbines, *Turbines, *Hydroelectric plants, *Tadami project, Reservoirs, Model studies, Flow characteristics, Cavitation, Stayvanes, Computer studies, Concrete stresses, Fatigue strength, Static load, Turbines, Concrete testing, Vibration testing.

The bulb turbine unit is considered to be one of the most appropriate solutions for the economical development of low head hydro energy. The 65 MW bulb unit for the Tadami project which is now being manufactured is the world's largest capacity machine. Prior to the manufacture of the prototype

machine, extensive tests were carried out on hydraulic, structural and vibration test models as well as extensive computer studies and analyses to ensure high performance and reliability. (Author's abstract)
W87-02691

SELF-CLOSING CYLINDRICAL GATE IMPROVES SAFETY AT LOW COST,
Vysoka Skola Chemicko-Technologicka, Prague (Czechoslovakia). Inst. of Water Technology and Environmental Protection.
P. Hudon.
Water Power and Dam Construction, Vol. 38, No. 8, p 45-48, August 1986. 4 fig, 4 ref.

Descriptors: *Cylindrical gates, *Turbines, *Gates, *Cost benefits, *Safety, *La Grande Complex, Uneven load testing, Asymetrical flow, Stayrings, Hydroelectric plants, Design, Canada, Hydraulic equipment.

The self-closing cylindrical gate is a particularly attractive device for hydro turbine protection because of its low impact on the overall cost of the installation. The gate is a thin, short cylinder which, in the closed position, blocks the hydraulic passage between the distributor and the stayring. In the open position it is housed in a compartment formed by the stayring and the head cover. Developments and performances achieved on recent major projects have demonstrated certain advantages of this type of gate over conventional valves. The mechanism developed to achieve the self-closing capability is based on a set of linear single-acting hydraulic servo-motors mounted on the flange of the head cover. The servomotors are interconnected by a mechanism that implements horizontal displacement of the gate and distribution of symmetrical loads. Synchronization is achieved by a high performance roller-screw system. Protective devices would stop the gate from closing should maximum synchronization pre-set values be excluded. Recordings made during flow shutoff will serve to illustrate the behavior of the gate during emergency closure. (Alexander-PTT)
W87-02693

SIZING SUBMERSIBLE PUMPS,
D. Maurer.
Water Engineering and Management WENMD2, Vol. 133, No. 6, p 37-38, 40-43, June 1986. 8 fig, 4 tab.

Descriptors: *Submersible pumps, *Lift station design, *Design flow, Planning, Wastewater facilities, Pumps, Velocity head.

Most consulting engineers have a standard approach to lift station design. The existing community needs, future development potential, local codes and regulations, elevations, force mains, etc. are considered and evaluated, to arrive at a design flow. However, consulting engineers also consider pump flexibility, pump history, pump service and pump performance. System curves can be expanded to incorporate one curve at minimum sump level and a second curve at maximum sump level. Where two or more pumps discharge into a common header pipeline, it is usually advantageous to ignore the head losses in the individual pump discharge (called station losses) in the head capacity curves. In systems where there is high velocity, velocity head must also be considered, and figured into the total dynamic head of the system. This system curve analysis gives the design engineer and the manufacturer of the equipment confidence about how the pumps will operate within the system. (Khumbatta-PTT)
W87-02927

INSTRUMENTS AND EXPERTISE ADD UP TO GOOD PIPE LOCATING,
Heath Consultants, Inc., Houston, TX.
T. G. Brown.
Water Engineering and Management WENMD2, Vol. 133, No. 6, p 45-46, June 1986.

Descriptors: *Excavation, *Pipe locators, *Water conveyance, *Underground systems, *Water distribution, Valve box locators, Instrumentation, Water transport, Aqueducts.

Different types of underground utility systems have had been installed to meet the needs of water transmission and distribution, wastewater collection, natural gas propane, oil, electric power, telephone, traffic control and cable television. Accidental damages have occured due to the excavation work, which is a major cause of concern to municipalities and businesses. Water utilities should know the locations of the elements in their systems, and the locations of all other utility components in the area of any planned excavation. All water distribution systems should have accurate, up-to-date maps of their systems to assist assigned personnel. While making field repairs, the accuracy of existing maps should be checked and a complete survey of the system should be made. There are a wide range of pipe locators and valve box locators available for locating lines and valves in distribution systems accurately. Three basic types of valve box locators exist: (1) is the pancake type metal detector which transmits and receives signals from metallic objects; (2) the ferro-magnetic locator, a probe type locator equipped with two built-in sensors; and (3) the dip needle, a compass like instrument, which responds to the magnetizing of iron objects. Both pipe locators and valve box locators are readily available through water industry suppliers. It is the responsibility of the water utility to select and use appropriate instruments efficiently, conduct a systems survey, maintain accurate up-to-date maps and log books, and ensure proper pipe location before excavations are started. These steps will enable workers to respond efficiently in emergencies, minimize damage to property and other utility systems, and reduce operating costs. (Khumbatta-PTT)
W87-02928

DATA PROCESSING FOR HYDRO PLANT CONTROL,
Ateliers de Constructions Electriques de Charleroi (Belgium).
D. Lodang.
International Water Power and Dam Construction IWPCDM, Vol. 38, No. 9, p 18-22, September 1986. 3 fig.

Descriptors: *Hydroelectric plants, *Control systems, *Computers, Automation, Software, Failure protection.

Equipment manufactured by ACEC (Belgium) for controlling hydroelectric plants integrates software and hardware for monitoring and control. The components of the Chance 3000 series system for low-head (5-25 MW) and medium-sized (100-400 MW) power stations are described, including control system structure, turbine regulation, controller features, control room, and control software, and reliability and availability are discussed. The ACEC system uses a decentralized approach so that failure of one component does not cause failure of the whole system. (Rochester-PTT)
W87-03033

AUTOMATION OF A CHAIN OF RUN-OF-RIVER POWER STATIONS,
Energy Engineering International, Munich (Germany, F.R.).
J. Gruner.
International Water Power and Dam Construction IWPCDM, Vol. 38, No. 9, p 33-35, September 1986. 2 fig.

Descriptors: *Hydroelectric plants, *Automation, *Turbine automatic control system, *Power station automatic control system, *Control systems, Surges, Flushing, Emergency starting, Data processing, Main River, Danube River, Germany.

The turbine automatic control (tac) system and power station automatic control system (psac) designed and tested by Rhein-Main-Donau AG in partnership with Energy Engineering International is described, including description of system design, operational experience, central control and monitoring, and automation of the central control. The tac system provides start and stop and synchronization functions, and in addition, surge operation, flushing, emergency starting, and internal service supply. The psac system includes data acquisition, plant regulation, and control, either by relays or electronically. These systems have been employed on the Main and Danube Rivers. (Rochester-PTT)
W87-03035

COMPUTATION OF HYDRAULIC TRANSIENTS IN COMPLEX HYDRO SCHEMES,
Hydraulic Engineering Research Inst., Bucharest (Romania).
For primary bibliographic entry see Field 8A.
W87-03036

COMPARISON OF VARIOUS METHODS OF CONTROLLING THE LONG-TERM OPERATING REGIMES OF HYDROELECTRIC STATIONS,
A. Y. Aleksandrovskii, A. V. Pimkin, and G. F. Chernenko.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 2, p 67-69 February 1986. 2 tab, 5 ref. Translated from Gidrotekhnische Stroitel'stro, No. 2, p 4-5, February 1986.

Descriptors: *Hydroelectric power, *Hydroelectric plants, *Management planning, *Long-term planning, Reservoir operation, Optimization, Runoff, Stochastic hydrology.

This study was conducted to compare the two most common methods of planning the operating regimes of hydrostations: on the basis of dispatcher graphs, and on the basis of optimization procedures presently used respectively in the planning stage and in operation. When evaluating the results of comparative calculations, it is necessary to bear in mind a number of circumstances making them preliminary in a certain sense. A calculated time time interval equal to one month somewhat distorts the calculation results. Direct optimization with successive correction in the variant used did not take into account the possibility of a qualitative forecast of the volume of inflow for a period greater than one month. Hydrological and hydraulic characteristics of the pools of a hydrostation and the requirements of the power system and water users change both during planning and operation, which leads to a change in the operating conditions of the hydrostation. The construction of new hydro developments with reservoirs regulating the river runoff, the construction of transmission lines connecting individual components of the power system, etc., introduce substantial changes in the operating regime of a hydrostation. To take into account these changes it is necessary to correct (refine) the dispatcher regulations of the operating regimes of hydrostation reservoirs. The methods of forecasting the runoff are based on concepts of the runoff as a stochastic process, whereas optimization methods being used in practice require the deterministic assignment of the runoff characteristics for the future period of operation. (Lantz-PTT)
W87-03176

EXPERIENCE OF USING THE TURBINE-GENERATOR UNITS OF THE KOLYMA HYDROELECTRIC STATION FOR IDLE DISCHARGE OF WATER,
B. N. Yurkevich, A. Y. Afonin, S. G. Kukarskii, and I. N. Lukin.
Hydrotechnical Construction HYCOAR, Vol.20, No. 2, p 70-73, February 1986. 3 fig. Translated from Gidrotekhnische Stroitel'stro, No. 2, p 6-8, February 1986.

Descriptors: *Turbines, *Electrical equipment, *Kolyma, *Hydroelectric plants, Flow discharge, Hydroelectric power, Reservoirs, Operating policy.

Diagonal-flow turbines with the following technical characteristics have been installed at the Kolyma hydroelectric station: turbine capacity 184 MW; nominal rotational speed 214.3/min; maximum head 116 m; minimum erating head 94.6 m;

start-up head 40 m; runner diameter 4200 millimeters. The units of the Kolyma hydrostation have an umbrella layout with support on the turbine cover with three guide bearings, one of which is combined with a thrust bearing. Before the start of reservoir drawdown, it is important to clean the trash racks and water surface in front of the intake, to provide for the possibility of cleaning during drawdown. These measures would help to reduce the time of drawing down the reservoir of the Kolyma hydrostation from 500 to 350 h. The unit showed the possibility of long idling at a speed from 15% and higher. At speeds of 15-35% of the nominal, it is recommended to continuously feed oil under pressure to the friction zone. Discharges of less than 10 cu m/sec passed through the unit with a stationary rotor. No unfavorable phenomena were noted in this case. To provide reliable operation with a stationary rotor, it is necessary to know the value of the maximum permissible torque absorbable by the jacks. When drawing down a reservoir through the water passage of a unit the maximum discharge is reached during idling with a speed of 50-100% of the nominal. In the case of a decrease of the speed below 35% or when it is necessary to pass small discharges for a long time an operating regime with a stopped rotor is recommended. (Lantz-PTT)
W87-03177

EXPERIENCE IN CREATING MECHANICAL EQUIPMENT FOR NORTHERN HYDROELECTRIC STATIONS,
S. A. Bol'shev, and S. V. Leenson.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 2, p 74-83, February 1986. 7 fig, 6 ref. Translated from Gidrotekhnische Stroitel'stro, No. 2, p 9-15, February 1986.

Descriptors: *Hydraulic machinery, *Cold regions, *Hydroelectric plants, Intakes, Penstocks, Installation, Construction, Welding, Hydraulic structures.

To provide reliable and long-term operation of mechanical equipment for hydroelectric stations under harsh climatic conditions (at an air temperature below -45 C), it is necessary to develop and implement numerous special design and technological measures with consideration of the characteristics and experience of the installation and operation of structures already constructed. Mechanical equipment of surface spillways, mechanical equipment of deep outlets, characteristics of the mechanical equipment of the hydrostation intakes, penstocks, mechanical equipment of draft tubes, characteristics of the organization of installation works, materials used for mechanical equipment, manufacture of mechanical equipment and steel structures in a northern version, cutting and machining of the edges of workpieces, machining of parts and components, heat treatment of parts and their cold treatment, assembly of welded constructions, welding of components and structures, heat treatment with welded joints of components and structures, and quality control of welding joints are examined to determine an operating standard of hydroelectric stations in extreme cold regions. It was determined that it is necessary to heat-treat welded, cast, and forged parts, components, and structures intended for operation under harsh climatic conditions. (Lantz-PTT)
W87-03178

OVERSPEEDING PROCESSES IN REVERSIBLE UNITS OF PUMPED-STORAGE STATIONS,
N. N. Arshenevskii.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 2, p 83-87, February 1986. 4 fig, 1 tab, 4 ref. Translated from Gidrotekhnische Stroitel'stro, No. 2, p 16-18, February 1986.

Descriptors: *Overspeeding, *Pumped storage, *Storage reservoirs, Hydraulic machinery, Rotational speed, Penstocks, Hydroelectric plants, Reservoirs, Hydraulic gates, Operating policy.

When a reversible unit enters an overspeed regime, water hammer occurs, and the rotational speed exceeds the overspeed rpm determined from the universal characteristic, in connection with which a determination of the guarantees of regulation when designing a pumped-storage station should begin precisely with this process. This process of overspeeding a unit should be considered an emergency process, and should be assigned to the case of unusual loading combinations. If the pumped-storage station has a group (branched) scheme of penstocks, then this process is examined only for one unit, and the others in the given group can: (a) operate simultaneously with the power system; (b) drop the load; and (c) be stopped. The unit can be brought out of overspeeding by: (1) an emergency slide valve connecting the appropriate cavities of the servomotors with the accumulator of the oil-pressure system with the receiver tank; (2) closing the quick-acting gates; (3) manual control; or (4) closing the bulkhead gates. It is possible to use these methods also in combination. When designing a pumped-storage station complete calculations of the indicated methods should be performed with consideration of the particular closing regimes and scheme of penstocks. An analysis of the process of overspeeding should be continued both for mixed-flow and for diagonal- and axial-flow reversible machines. (Lantz-PTT)
W87-03179

LOW-HEAD PUMPED-STORAGE STATION AS A WAY OF EXPANDING THE TSIMLYANSK HYDROELECTRIC STATION,
B. M. Groznov, and N. I. Kochkin.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 2, p 97-102, February 1986. 3 fig. Translated from Gidrotekhnische Stroitel'stro, No. 2, p 25-29, February 1986.

Descriptors: *Pumped storage, *Hydroelectric plants, *Storage reservoirs, *Tsimlyansk, Cost-benefit analysis, Hydroelectric power, Rostov, Russia, Floods, Reservoirs.

Soviet and world experience in the design and construction of pumped-storage stations has shown that the construction of pumped-storage stations at heads less than 50-60 m are, as a rule, economically ineffective. However, the program of wide construction of nuclear power stations decided on in recent years has increased the need for pumped-storage stations charging nuclear power stations during the night off-peak hours for the load curve. The construction of a pumped-storage station (PSS) as part of an existing hydro development, opens the possibility of using favorable factors, complete consideration of which can reveal the effectiveness of constructing even a low-head PSS. Design studies of the All-Union Planning, Surveying, and Scientific-Research Institute (Gidroproekt) as part of the substantiating materials for expanding the Tsimlyansk hydroelectric station (HES) showed, for example, that the construction of a low-head PSS at the Tsimlyansk hydro development, even under present conditions, is a sufficiently effective measure (payback time of the additional capital investments is 5.5-7 years). The location of the PSS in the center of the loads, and the proximity of the Rostov NPS presently under construction, will make it possible to reduce specific expenditures for constructing outside transmission lines. With construction of the PSS, the total discharage capacity of the turbines at the hydro development will increase by more than 7 times, as a result of which, an additional seasonal production amounting to 200 million kWh is possible, due to the previously unused waste discharges. On the whole, as the technical and economic calculations showed, the construction at the Tsimlyansk hydro development of a low-heat PSS with an installed capacity in the turbine regime of 800,000 kW, with production of 1.4-1.5 billion kWh/yr, with specific capital investments referred to the power industry of not more than 300-350 rubles/kW is a rather effective measure (payback time of the additional expenditures is 5.5-7 years). (Lantz-PTT)
W87-03182

DIMENSIONLESS ANALYSIS OF OPTIMUM DESIGNS,
For primary bibliographic entry see Field 8A.
W87-03185

OPERATIONAL TOOLS: SELECTIVE WITHDRAWAL AND DAILY OPERATIONAL STRATEGY,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 5G.
W87-03238

FLOW PROCESSES OF A CUTTERHEAD DREDGE,
Slotta Engineering Associates, Inc., Corvallis, OR.
L. S. Slotta.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 262-276, 12 fig, 1 tab, 4 ref. NSF Grant No. MEA-8360994.

Descriptors: *Flow characteristics, *Cutterhead dredge, *Hydraulic machinery, *Hydraulic models, Model studies, Computers, Performance evaluation, Computer models, Mathematical analysis, Dredging.

This research involves both three-dimensional numerical analyses and hydraulic model studies of rotating machinery involved in submerged sediment excavation. For both computer model and hydraulic model simulations, a cylindrical-shaped disc cutter can easily by extended to basket type cutters. The characteristic feature of the cylindrical shaped disc cutter is the potential optimal positioning of the suction mouth which extends into the interior of the cutter towards the rotating blades. Hydrodynamic computer codes (PHOENICS and FLUENT) were shown to have the promise of properly simulating complex, three-dimensional, rotating flows conveying water and sediments through dredge cutterheads. The hydraulic laboratory studies confirm that extending the intake pipe within the dredge cutter will significantly increase most hydraulic dredges' production. Tests compared: (a) plain suction mount, (b) long extended mouth, (c) 45-deg beveled mouth ('looking down'), (d) 45-deg beveled mouth with an internal cowl and a dog-eared external shroud, and (e) 45-deg beveled mouth with a dog-eared external shroud. Hydraulic model summary results show that maximum production was observed in the undercut mode at 48 RPM and when the 45-deg beveled mouth and external shroud were used. The 45.5% solids by weight concentration corresponds to a 24% solids by volume discharge. This production is quite impressive when compared to that achieved by most operational dredges. (See also W87-03248) (Lantz-PTT)
W87-03262

8D. Soil Mechanics

GEOLOGICAL PROBLEMS OVERCOME AT REVELSTOKE: PART TWO,
Marine Industries Ltd., Sorel (Quebec). Generator Section.
J. W. Forster.
Water Power and Dam Construction, Vol. 38, No. 8, p 42-44, August 1986. 9 fig, 7 ref.

Descriptors: *Spillways, *Foundations, *Headworks, *Earthfill dams, *Revelstoke, Dam construction, Overburden, Wave studies, Dam design, Bedrock, Geology, Columbia River, Canada, Geologic formations.

The Revelstoke project, including the first four of six generating units, was completed in 1985 essentially on budget and on schedule. This was accomplished despite a number of disadvantages. The most challenging of these was the complex and difficult bedrock geology at the concrete dam site in the canyon, and the extremely irregular bedrock and complex overburden at the earthfill dam site. Since the commissioning of the first four units, export sales to the US have absorbed any energy not required by BC Hydro so no spilling has been necessary. Some of the key reasons for the project's success were: an experienced design and construction team; good communications between field and design staff; satellite precipitation and tributary flow monitoring; utilization of specialists

as required; and periodic reviews of the design and construction. (Alexander-PTT)
W87-02692

METHOD OF INVESTIGATING THE COMPACTIBILITY OF COHESIVE SOILS,
O. A. Pakhomov.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 12, p 639-646, December 1985. 4 fig, 2 tab, 6 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, Vol. 19, No. 12, p 7-12, December 1985. .

Descriptors: *Soil compaction, *Cohesive soils, *Hydraulic design, *Soil engineering, *Soil properties, Soil types, Compaction, Engineering, Construction, Compressibility, Strength, Construction methods, Construction equipment, Soil water, Particle size.

When constructing earth structures from cohesive soils, optimum values of moisture content and maximum density values should be determined and correlated with the type of compacting machine. The method for determining compactibility should be selected as a function of the particle size distribution of the material being tested. When the type of roller and the pressure it applies to the soil are known, it is sufficent to perform one cycle of determination of the characteristics of compactibility for one value of the mass of the weight on the standard instrument or pressure of the plate in the consolidation press and as a result to obtain one value of the optimum moisture content and one value of the maximum density corresponding to it. If the type of roller is not known, then it is necessary to perform several cycles of determination and to obtain two interrelated functions by means of which the necessary values of the optimum moisture content and maximum density can be selected. (Doria-PTT)
W87-02865

GRAPHIC PLOTTING OF THE RELATIONSHIPS OF PHYSICAL CHARACTERISTICS OF SOILS,
L. P. Konovalov.
Hydrotechnical Construction HYCOAR, Vol. 19, No. 12, p 688-691, December 1985. 1 fig, 11 ref. Translated from Gidrotekhnicheskoe Stroitel'stvo, No. 12, p 38-40, December 1985.

Descriptors: *Graphical analysis, *Soil physical properties, *Mathematical studies, *Graphical methods, Model studies, Soil physics, Soil properties, Soil water, Soil density, Soil engineering, Soil porosity, Soil compaction, Compaction, Soil types.

A 'composition-property' diagram of soil, regarded as a three-component system is proposed. The diagram simultaneously models an entire complex of interdependences on the physical characteristics of soil, while showing the position of possible limits of its physical state. It is concluded that a geometric interpretation of the characteristics and states of soils, in the form of an ordered set of points, imparts simplicity and clarity to the diagram. This then promotes a broader comprehension of the interrelations of the soil characteristics and their evolution, during changes in soil state. In addition to being clearly illustrative, the diagram also has an applied calculation significance, since the simplicity of plotting and the accuracy and quickness of determining the physical characteristics is useful to designers, researchers, and builders. (Doria-PTT)
W87-02871

TWO-CHAMBER CONSOLIDATION PRESS,
V. P. Videneev, S. N. Gol'tsov, V. P. Kustov, and K. V. Ruppeneit.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 2, p 103-107, February 1986. 5 fig, 3 tab, 3 ref. Translated from Gidrotekhnische Stroitel'stro, No. 2, p 30-32, February 1986.

Descriptors: *Soil properties, *Consolidation press, *Compressibility, Compaction, Hydraulic machinery, Soil compaction, Soil mechanics.

During tests of the compressibility of soils with consolidation presses, the state of dense soils of semisolid and solid consistency, does not change up to pressures of 0.8-1.2 MPa during loading. For these soils, the modulus of deformation in the entire range of loads, is constant and greater than that obtained according to GOST 23908-79 (Method of Laboratory Determination of Compressibility) by 1.6-2.5 times. For soils of very soft and liquid consistency, the state of the soil changes during the experiments, and the ratio of the moduli of deformation found from the results of testing two samples of different height, and according to GOST, is variable. In any given experiment, this ratio varies 1.03-1.35. For evaluating the possibility of using the results of consolidation tests of weak saturated clays when designing the bases of structures, it is necessary to take into account the difference in the consolidation realized instrument and in the prototype. (Lantz-PTT)
W87-03183

CONSTRUCTION OF DAMS ON SOILS CONTAINING SOLUBLE SALTS,
For primary bibliographic entry see Field 8E.
W87-03186

GROUNDWATER SEEPAGE VECTORS AND THE POTENTIAL FOR HILLSLOPE FAILURE AND DEBRIS FLOW MOBILIZATION,
Cascades Volcano Observatory, Vancouver, WA.
For primary bibliographic entry see Field 2F.
W87-03193

LIME-CEMENT HARDENING OF VERY SOFT FRESHWATER CLAY,
Kyoto Univ. (Japan). Dept. of Civil Engineering.
M. Kamon.
IN: Management of Bottom Sediments Containing Toxic Substances, Proceedings of the 10th U.S./Japan Experts Meeting, October 30-31, 1984, Kyoto, Japan. October 1985. p 237-248, 9 fig, 1 tab, 4 ref.

Descriptors: *Hardness, *Lime, *Cements, *Clays, *Land reclamation, Pozzolans, Ettringites, Halloysite, Kaolinite, X-ray diffraction, Electron microscopy.

The hardening treatment of freshwater, very soft, clay soil formed by land reclamation was introduced. The applicability of a lime-cement-mixture was investigated in the laboratory. This special stabilizing agent directs itself to the pozzolanic reaction and ettringite product, in order to solidify very soft clay soils by enclosing free water into its crystal. The hardening mechanism was examined physicochemically. The results obtained are as follows: (1) Freshwater, very soft, clay soils used are mainly halloysite and kaolinite minerals in suspension for a long time. Thus, the strength due to self-consolidation after sedimentation is very small; (2) The hardening strength increases with the increase in the added volume of stabilizing agents. Trafficability on this soft ground is obtained by adding more than 15% of the stabilizing agent; (3) The optimum combination ratio is 9:1 to 8:2. Beyond these ratios, the effect of the ettringite crystal reduces the hardening strength; and (4) The hardening mechanism was quantitatively shown in the reactive products by X-ray diffraction analysis and scanning electron microscopy. It was clearly seen that the pozzolanic reaction products are directly related to the strength increase. (See also W87-03248) (Lantz-PTT)
W87-03260

8E. Rock Mechanics and Geology

GEOLOGICAL PROBLEMS OVERCOME AT REVELSTOKE: PART TWO,
Marine Industries Ltd., Sorel (Quebec). Generator Section.
For primary bibliographic entry see Field 8D.
W87-02692

BOREHOLE TELEVISION FOR GEOTECHNICAL INVESTIGATIONS,
Westinghouse Electric Corp., Horseheads, NY. Industry and Government Tube Div.
For primary bibliographic entry see Field 7B.
W87-03032

ROCKFALL-INDUCED WAVES IN RESERVOIRS,
Eidgenoessische Technische Hochschule, Zurich (Switzerland).
D. L. Vischer.
International Water Power and Dam Construction IWPCDM, Vol. 38, No. 9, p 45-48, September 1986. 6 fig, 4 ref.

Descriptors: *Rockfalls, *Reservoirs, *Wave action, *Slope stability, *Mudflows, Mathematical models, Hydraulic models, Potential energy, Kinetic energy, Turbulence, Lakes, Hydraulic jump, Hydrodynamics.

Hydrodynamic effects of rockfalls were investigated in two-dimensional and three-dimensional model tests. The characteristics of three types of shore instabilities, falls, slides, and flows are described and results obtained with hydraulic models of 1:50 to 1:500 scales are presented. The rockfall was simulated by a gravel mixture and the fall path by an inclined plane. The generation of the waves under consideration results from the impact between the rock mass and the quiescent water body. An impulse exchange occurs, with a corresponding exchange of energy. The energy balance can be written: E sub kin + E sub pot = E sub w + E sub o, in which the terms are, respectively, kinetic energy of the plunging rock mass; potential energy of the plunging mass with respect to the reservoir or lake bottom; resultant wave energy; and energy expended in other ways, such as turbulent dissipation at the plunge point, internal an external friction losses of the plunging mass, and generation of shock waves. The rock plunge is analogous to a hydraulic jump. Practical conclusions that can be drawn from the present energy analysis are: (1) the efficiency of fall-energy conversion into wave energy is 1.5-35% for the investigated range of parameters; (2) the conversion decreases strongly with increasing Froude number; (3) the conversion efficiency is lower than that occurring in landslides; and (4) the plunging of landslides into reservoirs or lakes is potentially more dangerous than the plunging of rockfalls of similar volume. (Rochester-PTT)
W87-03037

ANALYSIS OF METHODS OF DETERMINING THE COMPRESSIVE STRENGTH OF ROCKS,
L. G. Medvedev, and R. I. Teder.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 2, p 88-94, February 1986. 6 fig, 11 ref. Translated from Gidrotekhnische Stroitel'stro, No. 2, p 18-23, February 1986.

Descriptors: *Compressive strength, *Rocks, *Mathematical analysis, *Rock testing, Cleavage, Rock properties, Hardness, Strength, Rock prisms.

The diversity of methods for compression testing of rocks, and the appearance of a great number of new ones, indicate that they do not completely satisfy the requirements occurring in connection with practical activity in the area of mining industry and construction. The development and improvement of methods of determining the compressive strength of rocks under laboratory, field, and production conditions are continuing. State standardization of methods of physical testing of rocks, including methods of determining the uniaxial compressive strength, has been being carried out during the past 10 years. The methods of (1) determining the uniaxial compressive strength (GOST 21153.2-75), (2) determining the multiple cleavage and compressive strengths (GOST 21153.4-75), (3) combined rapid determination of the uniaxial tensile and compressive strength (OST 12.14.116-79), (4) determining the compressive strength from the hardness index obtained by means of a Kashkarov-Poldi-Hutte hammer, (5) compression of large prisms, and (6) investigating rocks in a three-dimensional stress state under all-around compression, are discussed. Methods for

crushing large rock prisms should be used when construction occurs. In this case, it is necessary to fulfill the requirements of the basic principles of mathematical statistics (to take into account variation of the indices, to select the necessary number of repeated determinations, to fulfill identify of the conditions of repeated determinations, etc.). When determining the compressive strength on large prisms, one must simultaneously determine the compressive strength of rocks by one or two methods on small samples (GOST 21153.2-75 and GOST 21153.4075). (Lantz-PTT)
W87-03180

USE OF GROUTING WHEN DRIVING THROUGH THE ROCK BURST ZONE IN THE DANGARA IRRIGATION TUNNEL,
Y. A. Vasenko.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 2, p 94-96, February 1986. 1 fig. Translated from Gidrotekhnische Stroitel'stro, No. 2, p 23-25, February 1986.

Descriptors: *Grouting, *Rock burst zone, *Irrigation, *Dangara, *Tunnel construction, Construction, Groundwater, Tunneling, Cements.

In Tadzhikistan an irrigation tunnel with a length of 13,813 m and with a cross section of 42 sq m, is being constructed for irrigating arid lands of the Dangara Valley. The irrigation tunnel will be able to discharge 100 cu m/sec, which will make it possible to irrigate 100,000 ha of cotton and other crops. The route of the tunnel passes through complex mining and geological conditions, intersecting several faults. Groundwaters were found during drilling in the crown and left wall of the tunnel. Directly before the crush zone, the tunnel crown was supported by rock bolts with cross supports of reinforcing bar and shotcrete. When determining the method of tunneling in the rock burst zone, variants of bypassing the stretch of the burst to the right and left of the design route and driving the tunnel through the rock pile were examined as the main ones. The grouting works were divided into two stages: infilling grouting of the voids of the rock burst, and consolidation grouting of the rock pile. Infilling grouting was carried out by feeding a thick cement grout of consistency 1:0.5 (cement:water by weight) through holes directly into the voids of the rock burst from the grout unit located on the shaft surface. Consolidation grouting was carried out in two cycles to reduce the length of the holes, which in the case of grouting in one cycle would have been 57 m. The holes for consolidation grouting were arranged within a 10-m layer above the apex of the tunnel crown at a maximum distance of 2 m from each other. The length of the grouted intervals of the holes varied within 5-14 m. The sequence of filling the holes was as follows: first the upper holes were filled under a smaller pressure to avoid breakthrough of the grout through the surcharge; then the lower holes are filled. The maximum compression of the rocks was thus accomplished directly along the design contour of the tunnel crown. Grouting began with a consistency of 1:2, and in the case of high rates of absorption, the grout was thickened to 1:1 and 1:0.8. Injection was carried out until there was a complete refusal to absorption, at a pressure of 2-2.5 MPa. In all, in the second stage, 671 m of grouting the holes was performed, and 566 tons of grout was absorbed. (Lantz-PTT)
W87-03181

CONSTRUCTION OF DAMS ON SOILS CONTAINING SOLUBLE SALTS,
V. P. Nedriga, and E. A. Dem'yanova.
Hydrotechnical Construction HYCOAR, Vol. 20, No. 2, p 116-121, February 1986. 4 fig. Translated from Gidrotekhnische Stroitel'stro, No. 2, p 44-47, February 1986.

Descriptors: *Dam construction, *Solubility, *Salts, *Soil porosity, Geohydrology, Hydraulic engineering, Foundation rocks, Gypsum, Anhydrite, Halite, Tbilisi Dam, Russia, Saint Francis dam, Leaching, Kama River.

The intense development of natural resources of Eastern Siberia and Central Asia is making it necessary for hydraulic engineers to construct dams under complex hydrogeological conditions, on foundations containing soluble rocks, mainly gypsum, anhydrite, and halite. World dam construction practice has numerous examples of constructing dams on gypsinate foundations. It is necessary, however, to note that in the majority of cases, the presence of gypsum in the foundation of the dams, was found during operation of the structures upon the occurrence of incidents due to chemical piping. In those cases, when the presence of gypsum in rocks of the foundation was found during surveys, construction, as a rule, was ruled out when considering the experience of operating dams with such foundations. The Tbilisi dam (USSR) and the Saint Francis dam (USA), are discussed as examples of an underestimation of the consequences of developing chemical piping. The Kama hydro development on the Kama River serves as an example of the successful construction of a structure on gyprocks. The upper part of its foundation, to a depth of 50 m, is composed of hard and soft rocks represented by sandstones, argillites, limestones, dolomites, and marls, and the lower part by a sulfate complex, in the form of beds of gypsum and anhydrite, with a thickness of approximately 120 m. Mathematical calculations to determine the time and boundary of leaching, conclude that the construction of dams on foundations containing water-soluble salts, is possible, but requires substantial attention to establishing the geological and hydrogeological conditions of the site. The necessary conditions determining the possibility of constructing dams on gypsinate and salinized foundations are: low permeability of the rocks; the possibility of taking protective measures; presence of a gallery in the foundation for making a thorough check of the state of the structure and performing, when necessary, works on the construction and restoration of the watertight properties of the grout curtain. (Lantz-PTT)
W87-03186

LATE QUATERNARY ALLUVIAL STRATIGRAPHY OF WHITEWATER DRAW, ARIZONA: IMPLICATIONS FOR REGIONAL CORRELATION OF FLUVIAL DEPOSITS IN THE AMERICAN SOUTHWEST,
M. R. Waters.
Geology GLGYB, Vol. 13, No. 10, p 705-708, October 1985. 3 fig, 14 ref. Wenner-Gren Foundation for Anthropological Research Grant-in-aid No. 4335.

Descriptors: *Geology, *Arizona, *Whitewater Draw, *Alluvial deposits, Fluvial sediments, History, Sulphur Springs Valley, San Pedro Valley, Semiarid regions, Geomorphology, Arroyo.

The alluvial history of Whitewater Draw, an arroyo in the Sulphur Springs Valley, southeastern Arizona, is characterized by numerous degradational and aggradational events. Shifts in climate appear to be responsible for the major changes in depositional environments recognized in Whitewater Draw over the past 15,000 yr. However, the degradation and aggradation documented during apparently stable climatic periods, were primarily controlled by geomorphic parameters. Comparison between the alluvial records of arroyos in the adjacent upper San Pedro Valley and Whitewater Draw, shows that periods of degradation and aggradation were out of phase in number, character, and timing. These differences indicate that the fluvial systems in the Sulphur Springs Valley and the San Pedro Valley responded differently to external climate shifts, and that both systems were influenced by local geomorphic parameters. This demonstrates that the regional correlation of late Quaternary deposits from one valley to the next should not be attempted without absolute temporal control, and that intervalley correlations must take into consideration the complexity of fluvial processes. (Author's abstract)
W87-03209

TUNNELS: MACHINE EXCAVATION - RATE OF PROGRESS - MACHINE DATA,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 8A.
W87-03320

8F. Concrete

RCC: A DAM REHAB SOLUTION UNEARTHED,
Portland Cement Association, Denver, CO.
K. D. Hansen, and J. W. France.
Civil Engineering CEWRA9, Vol. 56, No. 9, p 60-63, September 1986. 3 fig.

Descriptors: *Roller-compacted concrete, *Concretes, *Dam construction, *Hydraulic engineering, *Concrete technology, Reinforced concrete, Hydraulic structures, Concrete dams, Engineering, Construction, Construction materials, Embankments, Overflow, Concrete mixes, Portland cement.

Roller-compacted concrete (RCC), hauled and spread by earthmoving equipment and compacted by vibratory rollers, has been so successful for repairing dams that the number of dam rehabilitation projects using RCC may eventually dwarf the number of new RCC dams. RCC has been shown to be cheaper, quicker to construct, and as reliable as more traditional rehab approaches. Most such projects fall into two categories: fixing damaged overflow structures, and protecting embankment dams during overtopping. Examples of successful projects are provided, and design considerations are discussed. Design details require careful attention, especially at the crest, downstream slope, and downstream tow. RCC mixtures range from 5% to 10% cementitious material (portland cement plus fly ash) by dry weight of aggregate. The best aggregates for RCC use are well-graded, angular soils ranging from one to two inches maximum size down to 5% to 10% nonplastic fines passing the No. 200 sieve. (Doria-PTT)
W87-02770

LATEX ADMIXTURES FOR PORTLAND CEMENT CONCRETE AND MORTAR,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Structures Lab.
For primary bibliographic entry see Field 8G.
W87-03318

ALKALI-SILICA REACTIVITY IN FIVE DAMS IN SOUTHWESTERN UNITED STATES,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
D. Stark.
Available from the National Technical Information Service, Springfield, VA. 22161 as PB86-235082, A04 in paper copy, A01 in microfiche. Report No. REC-ERC-85-10, July 1985. 64 p, 8 ref, 5 append. Contract No. 4-CP-81-03540.

Descriptors: *Concretes, *Concrete testing, *Silica, *Coolidge Dam, *Friant Dam, *Matilija Dam, *Parker Dam, *Stewart Mountain Dam, Dams, Chemical reactions, Structural engineering, Humidity, Bases, Petrography, Chemical reactions, Materials testing.

Concrete samples from five dams in the Southwest (Coolidge, Friant, Matilija, Parker, and Stewart Mountain Dams) were tested for alkali-silica reactivity. This investigation was intended to study the state of alkali-silica reactivity in the concrete and to determine the potential for additional reactivity. The four procedures used in this investigation were selected to determine whether the concrete contained potentially reactive silica or enough moisture to cause expansion. These procedures were relative humidity measurements, petrographic examinations, length change measurements, and osmotic cell tests. Test results showed that the extent of alkali-silica reactivity and the potential for its occurrence varied not only between dams, but also between sample locations within each dam. (Author's abstract)
W87-03319

8G. Materials

INNOVATIVE LAGOON LINER PAYS OFF,
Greiner Engineering, Inc., Denver, CO.
For primary bibliographic entry see Field 5D.
W87-03078

LATEX ADMIXTURES FOR PORTLAND CEMENT CONCRETE AND MORTAR,
Army Engineer Waterways Experiment Station, Vicksburg, MS. Structures Lab.
D. L. Bean, and T. B. Husbands.
Available from the National Technical Information Service, Springfield, VA. 22161. Technical Report REMR-CS-3, July 1986. Final Report. 35 p, 9 fig, 12 tab, 12 ref.

Descriptors: *Latex, *Portland cements, *Concretes, *Mortar, Polymers, Aggregates, Literature review, Reviews, Vapor pressure, Maintenance, Latex-modified mortar.

A latex used as an admixture in portland cement concrete or mortar is a water-emulsion organic polymer. This polymer emulsion will coalesce to form a continuous film within the matrix of the paste and around the aggregate, thus producing greater tensile and flexural strength and a more durable material (because it acts as a moisture barrier to the entry of liquid water but allows water vapor to migrate out). A literature search was conducted to collect information about latex admixtures and some minor laboratory testing was performed to corroborate some of the literature findings. The results of the latex-modified mortar (LMM) bond test indicate that the surface of concrete or hardened LMM does not need to be primed to obtain good adhesion. The percentage of polymer in the LMM does affect the water vapor transmittance (breathability) of the specimen. A higher percentage of polymer will reduce the vapor transmittance of the hardened mortar. The underwater submersion data revealed that immersion did not weaken the mortar tested at WES when allowed to air-dry sufficiently before testing. If the absorbed moisture in the LMM could evaporate after the specimen was removed from the water, the strengths were returned to their expected values. However, this may not be true for all acrylic latex modifiers; some may contain ethyl or methyl acrylates which are hydrolized when submerged in water. Further testing and evaluation are needed for various types of modifiers. The results of the freezing and thawing testing of mortar patches showed that some latex mortars performed much better than others. Visual examination of the patches indicated that the principal cause of degradation was separation of the patches from the test panels. (Lantz-PTT)
W87-03318

8H. Rapid Excavation

TUNNELS: MACHINE EXCAVATION - RATE OF PROGRESS - MACHINE DATA,
Bureau of Reclamation, Denver, CO. Engineering and Research Center.
For primary bibliographic entry see Field 8A.
W87-03320

8I. Fisheries Engineering

PASSIVE SCREEN WATER INTAKE DESIGN STUDIES,
Minnesota Univ., Minneapolis. St. Anthony Falls Hydraulic Lab.
H. G. Stefan, W. Q. Dahlin, T. Winterstein, and P. Fournier.
Journal of Energy Engineering (ASCE) JLEED9, Vol. 112, No. 2, p 115-126, August 1986. 15 fig, 9 ref.

Descriptors: *Screens, *Intakes, *Hydraulic structures, *Hydraulic design, *Fish barriers, *Powerplants, Fish, Larvae, Regulations, Legal aspects, Ice, Pipes, Water transport.

Experimental and analytical studies were conducted to develop a novel water intake design for the prevention of fish impingement and excessive damage to fish larvae at a powerplant in Jackson, Michigan. Requirements by the regulatory agency led to the use of cylindrical screens mounted in pairs on 'risers' connected to four manifolds, which in turn were connected to an 18 ft diameter withdrawal pipe carrying a total flow of 23.2 cu m/s (818 cfs) to a powerplant condenser. Separate model studies conducted on individual screen panels, individual and multiple risers, and manifolds are described. The studies conducted at scale ratios ranging from 1:20-1:3 are described. The system, built in 1981, continues to work well with only minor damage caused by ice. (Author's abstract)
W87-02767

SYNTHESIS AND ANALYSIS OF A COMPREHENSIVE LAKE MODEL - WITH THE EVALUATION OF DIVERSITY OF ECOSYSTEMS,
National Inst. for Environmental Studies, Tsukuba (Japan). Water and Soil Environment Div.
For primary bibliographic entry see Field 2H.
W87-02965

SEASONAL ABUNDANCE, GROWTH, FEEDING AND AGE COMPOSITION OF FLOUNDER (PLATICHTHYS FLESUS (L.)) POPULATIONS OF THE SEVERN ESTUARY AND BRISTOL CHANNEL,
Bath Univ. (England). School of Biological Sciences.
For primary bibliographic entry see Field 2L.
W87-03027

9. MANPOWER, GRANTS AND FACILITIES

9D. Grants, Contracts, and Research Act Allotments

HISTORY OF THE FEDERAL-STATE COOPERATIVE WATER RESOURCES RESEARCH INSTITUTE PROGRAM,
Geological Survey, Reston, VA. Water Resources Div.
J. S. Burton.
Water Resources Bulletin WARBAQ, Vol. 22, No. 4, p 637-647, August 1986. 2 fig, 5 tab, 42 ref.

Descriptors: *Water resources institutes, *Research facilities, *Grants, *History, *Information exchange, Legislation, Participating funds, Public investment.

A brief history of the State Water Resources Research Institute program is presented. Components of the program include an annual allotment and matching grants program for the Institutes and the additional and saline water research programs for other organizations. The legislative history of the Institute program and authorized and appropriated funding from fiscal years 1965 through 1986 are reviewed. The Institute's role in conducting and sponsoring water resources research and development, training of scientists and engineers and coordinating, transferring and disseminating water research data is discussed. Examples of several water research projects sponsored by this program are included. (Michael-PTT)
W87-02632

10. SCIENTIFIC AND TECHNICAL INFORMATION

10C. Secondary Publication And Distribution

PROCEEDINGS: CE WORKSHOP ON DESIGN AND OPERATION OF SELECTIVE WITHDRAWAL INTAKE STRUCTURES.
Army Engineer Waterways Experiment Station, Vicksburg, MS. Hydraulics Lab.
For primary bibliographic entry see Field 8A.
W87-03221

10F. Preparation Of Reviews

ASBESTOS IN POTABLE WATER SUPPLIES AND ATTRIBUTABLE RISK OF GASTROINTESTINAL CANCER,
Mount Sinai School of Medicine, New York. Environmental Sciences Lab.
For primary bibliographic entry see Field 5C.
W87-02830

PHYSIOLOGICAL INNOCUITY OF ASBESTOS IN WATER,
Societe Nationale de l'Amiante, Sherbrook (Quebec).
For primary bibliographic entry see Field 5C.
W87-02831

SUBJECT INDEX

ABSCISIC ACID
Triadimefon Protects Bean Plants from Water Stress through its Effects on Abscisic Acid,
W87-03202 2I

Accumulation and Turnover of Abscisic Acid in Osmotically Stressed Cotton Leaf Tissue in Relation to Temperature,
W87-03216 2I

ACCIDENTS
Water-hammer Diagnostic Established by A Numerical Method, (Un Diagnostic de Coup de Belier Etabli par Modele Numerique),
W87-02577 8C

ACCLIMATION
Absence of Acclimation to Parathion by Rainbow Trout During Sublethal Exposure,
W87-02697 5C

Avoidance-Preference Reactions of Rainbow Trout (Salmo Gairdneri) After Prolonged Exposure to Chromium(VI),
W87-02698 5C

Primary and Secondary Stress Responses of Striped Bass (Morone saxatilis) Exposed to Benzene,
W87-02771 5C

ACCUMULATION
Phosphorus Uptake by Klebsiella pneumoniae and Acinetobacter calcoaceticus,
W87-02741 5D

Some Physiological Characteristics of Acinetobacter spp. Accumulating Large Amounts of Phosphate,
W87-02742 5D

Relationships Among Growth Rate, Cellular Manganese Concentrations and Manganese Transport Kinetics in Estuarine and Oceanic Species of the Diatom Thalassiosira,
W87-02805 2L

Micronutrient Tolerance and Accumulation in the Duckweed, Lemna,
W87-03153 5C

ACETATES
Biogenic Methane Formation in Marine and Freshwater Environments: CO2 Reduction vs. Acetate Fermentation-Isotope Evidence,
W87-03137 5B

ACID ICE WATER
Growth and Nutritional Status of Petunia and Tomato Seedlings with Acidified Irrigation Water,
W87-03105 5C

ACID RAIN
Environmental Factors Affecting the Acid Neutralization Capacity of Finnish Glacial Till Deposits,
W87-02588 5B

Preliminary Model of Long-Term Changes in Stream Acidity in Southwestern Scotland,
W87-02682 5G

Modelling the Effects of Hydrological Changes on Stream Water Acidity,
W87-02684 2E

Composition of Precipitation Water and Its Acidity,
W87-02721 5B

Study of Acid Deposition in Switzerland: Temporal Variation in the Ionic Composition of Wet Precipitation at Rural Sites During 1983-1984,
W87-02763 5B

Lake Acidification and the Land-Use Hypothesis: A Mid-Post-Glacial Analogue,
W87-02810 2K

Measurements of pH versus Drop Size in Natural Rain,
W87-02811 2B

Temporal Evolution of Nitrogen Compounds in Swedish Precipitation Since 1955,
W87-02812 2B

Modelling the Effects of Acidic Deposition And Conifer Afforestation on Stream Acidity in the British Uplands,
W87-03068 5C

Rates of Mineral Element Leaching from Leaves of Nine Plant Species from a Southern Appalachian Forest Succession Subjected to Simulated Acid Rain,
W87-03206 5C

Acid Rain: A Review of the Phenomenon in the EEC and Europe.
W87-03338 5C

ACID STREAMS
Preliminary Model of Long-Term Changes in Stream Acidity in Southwestern Scotland,
W87-02682 5G

Modelling the Effects of Hydrological Changes on Stream Water Acidity,
W87-02684 2E

ACIDIC WATER
Lake Acidification and the Land-Use Hypothesis: A Mid-Post-Glacial Analogue,
W87-02810 2K

Decomposition Studies in Two Central Ontario Lakes Having Surficial pHs of 4.6 and 6.6,
W87-02897 2H

Modelling the Effects of Acidic Deposition And Conifer Afforestation on Stream Acidity in the British Uplands,
W87-03068 5C

ACIDITY
Preliminary Model of Long-Term Changes in Stream Acidity in Southwestern Scotland,
W87-02682 5G

Modelling the Effects of Hydrological Changes on Stream Water Acidity,
W87-02684 2E

Composition of Precipitation Water and Its Acidity,
W87-02721 5B

Measurements of pH versus Drop Size in Natural Rain,
W87-02811 2B

Temporal Evolution of Nitrogen Compounds in Swedish Precipitation Since 1955,
W87-02812 2B

ACIDOGENIC REACTORS
Effect of Effluent Recirculation on the Performance of a Two Stage Anaerobic Process,
W87-03088 5D

ACINETOBACTER
Phosphorus Uptake by Klebsiella pneumoniae and Acinetobacter calcoaceticus,
W87-02741 5D

Some Physiological Characteristics of Acinetobacter spp. Accumulating Large Amounts of Phosphate,
W87-02742 5D

Aut-Ecological Study of Acinetobacter in Activated Sludge,
W87-02744 5D

ACRYLIC ACID
Determination of Acrylic Acid in Aqueous Samples by Electron Capture Gas Chromatography after Extraction with Tri-n-octylphosphine Oxide and Derivatization with Pentafluorobenzyl Bromide,
W87-02818 5A

ACTIVATED CARBON
Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-02751 5D

Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial Wastewater Reuse and Priority Pollutant Removal,
W87-02753 5D

Multielement Trace Preconcentration from Water on Activated Carbon for the Sample Pretreatment for Atomic Spectroscopy (Flame-AAS, ICP/OES), (Multielement-Spurenanreicherung aus Wassern an Aktivkohle zur Probenvorbereitung fur die Atomspektroskopie (Flammen-AAS, ICP/OES)),
W87-02799 5A

Bacteria Associated with Granular Activated Carbon Particles in Drinking Water,
W87-02891 5B

ACTIVATED SLUDGE
Effect of Seawater on Nitrification by Attached Biofilm,
W87-02603 5D

Microbial Polymers in the Aquatic Environment-I: Production by Activated Sludge Microorganisms under Different Conditions,
W87-02694 5D

Aut-Ecological Study of Acinetobacter in Activated Sludge,
W87-02744 5D

ACTIVATED SLUDGE PROCESS
Virus Removal by Activated Sludge Treatment,
W87-02658 5D

Starch Waste Treatment by the Activated Sludge System,
W87-02705 5D

Role of Bacterial Phosphate Metabolism in Enhanced Phosphorus Removal from the Activated Sludge Process,
W87-02743 5D

Biological Phosphorus and Nitrogen Removal at an Experimental Full Scale Plant in the U.K.,
W87-02750 5D

$5.00, 1-Minute Effluent Quality Tester,
W87-02814 7B

Operator's Guide to Protozoa and their Role in the Activated Sludge Process,
W87-02903 5D

Functional Design of Activated Sludge Processes with Heavy Metal Inhibition,
W87-03131 5D

ADSORPTION
Transport of Solutes in Soil: Basic Features of Front Retardation,
W87-02733 5B

Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-02751 5D

Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial Wastewater Reuse and Priority Pollutant Removal,
W87-02753 5D

ADSORPTION

Fluridone Retention and Release in Soils,
W87-02918 5B

ADVERSE EFFECTS
Cost Analysis of the Adverse Effects of Algal Growth in Water Bodies on Drinking Water Supply,
W87-02977 5F

AERATION ZONE
Examination of the Penetration of Enteric Viruses in Soils under Simulated Conditions in the Laboratory,
W87-02663 5B

AERO-AQUATIC FUNGI
Effects of Sulphide on Survival of Aero-Aquatic and Aquatic Hyphomycetes,
W87-03174 5C

AEROBIC DIGESTION
Bacteria and Viruses in Aerobically Digested Sludge: Influence of Physical and Chemical Treatments on Survival and Association with Flocs under Laboratory Conditions,
W87-02660 5D

AEROBIC TREATMENT
In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-02754 5G

AFRICA
Dissolved Material Concentration in Surface Waters of Africa. Two Contrasting Examples in the Rivers of Togo and the Medjerdah in Tunisia (Evolution de la Concentration en Matieres Dissoutes en Afrique. Deux Exemples Opposes: les Fleuves du Togo et la Medjerdah en Tunisie),
W87-03277 5B

AGRICULTURAL MACHINERY
Compaction, Hydrological Processes and Soil Erosion on Loamy Sands in East Shropshire, England,
W87-03160 2J

Effect of Deep Tillage and Controlled Traffic on Root Growth, Water-Use Efficiency and Yield of Irrigated Maize and Wheat,
W87-03165 3F

AGRICULTURAL MANAGEMENT MODELS
Efficient Response Matrix Method for Coupling a Groundwater Simulator and a Regional Agricultural Management Model,
W87-02936 4B

AGRICULTURAL RUNOFF
Alternatives to the Use of Agricultural Drainage Wells,
W87-02624 4B

AGRICULTURE
Ecological Modelling, Monitoring and Implementation in Irrigated Agriculture,
W87-02966 3F

AIR ENCAPSULATION
Air Encapsulation: I. Measurement in a Field Soil,
W87-02915 2G

Air Encapsulation: II. Profile Water Storage and Shallow Water Table Fluctuations,
W87-02916 2F

AIR ENTRAINMENT
Improved Monitoring of Air in Water,
W87-03038 7B

AIR PERMEABILITY
Physical Environment Near the Surface of Plowed and No-Tilled Soils,
W87-03171 2G

AIR POLLUTION
Atmospheric Methane Sources: Alaskan Tundra Bogs, an Alpine Fen, and a Subarctic Boreal Marsh,
W87-02719 5B

Concentrations of 20 Volatile Organic Compounds in the Air and Drinking Water of 350 Residents of New Jersey Compared with Concentrations in Their Exhaled Breath,
W87-02774 5B

Monitoring Pollution,
W87-03117 5A

AIR TEMPERATURE
Microclimate of an Upland Grassland,
W87-03101 2I

ALASKA
Atmospheric Methane Sources: Alaskan Tundra Bogs, an Alpine Fen, and a Subarctic Boreal Marsh,
W87-02719 5B

Review and Analysis of Methods for Quantifying Instream Flow Requirements,
W87-02933 6D

ALBERTA
Mixing Coefficient for Ice-covered and Free-surface Flows,
W87-02671 2E

ALCOHOLS
Biodegradation of Methanol and Tertiary Butyl Alcohol in Subsurface Systems,
W87-02732 5B

ALDER TREES
Red Alder Leaf Litter and Streamwater Quality in Western Oregon,
W87-02631 5B

ALFALFA GREENING
Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. II. Mineral Composition of Fruit and Leaves, Fruit Disorders, and Fruit Set,
W87-03111 3F

ALGAE
Seawater Induced Algal Flocculation,
W87-02703 5D

Toxicity of Brass Dust to the Microalgae Ankistrodesmus falcatus and Selenastrum capricornutum,
W87-02778 5C

Cost Analysis of the Adverse Effects of Algal Growth in Water Bodies on Drinking Water Supply,
W87-02977 5F

Test of a Proposed Organizational Framework for the Ordering of Algal Toxicity Responses,
W87-03205 5C

ALGAL CONTROL
Seawater Induced Algal Flocculation,
W87-02703 5D

ALGORITHMS
Computerized Layout Generation for Sanitary Sewers,
W87-03062 8A

ALLUVIAL AQUIFERS
Evolution in Space and Time of an Alluvial Aquifer under the Effect of an Exceptional Multi-Year Drought (Mediterranean Shore, Herault, France) (Evolution Spatio-Temporelle d'un Aquifere Alluvial sous l'Effet d'une Secheresse Pluriannuelle Exceptionnelle (Littoral Mediterraneen, Herault, France)),
W87-02838 2F

Regime of Ground Water of Semberian Aquifer,
W87-03043 2F

ALLUVIAL DEPOSITS
Late Quaternary Alluvial Stratigraphy of Whitewater Draw, Arizona: Implications for Regional Correlation of Fluvial Deposits in the American Southwest,
W87-03209 8E

ALLUVIAL PLAIN
Regime of Ground Water of Semberian Aquifer,
W87-03043 2F

ALUM CREEK LAKE
Selective Experiences: Alias Withdrawal Pains,
W87-03246 6B

ALUMINA
Application of Aluminas in Water Treatment,
W87-02752 5D

ALUMINUM
Water Sorption Characteristics of Aluminum- and Calcium-Saturated Soil Clays,
W87-02728 2G

ALUMINUM SALTS
Efficient Method of Applying Aluminum Salts for Sediment Phosphorus Inactivation in Lakes,
W87-02635 5G

AMAZON RIVER
Chemical Control of Soluble Phosphorus in the Amazon Estuary,
W87-03139 5B

AMBROSIA TRIFIDA
Growth and Survival of Giant Ragweed (Ambrosia trifida L.) in a Delaware River Freshwater Tidal Wetland,
W87-03207 2H

AMINO ACIDS
Effects of Seawater on Amino Acids and Mineral Ions Composition in Salicornia brachiata Roxb,
W87-03093 3C

AMMONIUM
New Procedure for Extraction of Ammonium from Natural Waters for 15N Isotopic Ratio Determinations,
W87-02902 5A

AMMONIUM METABOLISM
Ammonium (15N) Metabolism in Cotton Under Salt Stress,
W87-03151 5C

AMOCO CADIZ
Amoco Cadiz and Limitation of Liability for Oil Spill Pollution: Domestic and International Solutions,
W87-02593 6E

AMPEROMETRY
Two-Method Verification of Hydrogen Peroxide Determinations in Natural Waters,
W87-03050 5A

ANAEROBIC DIGESTION
Virus Inactivating Effect of Anaerobic Mesophilic Digestion of Municipal Sludge With or Without Different Preceding Types of Treatment,
W87-02661 5D

Kinetics of Biological Phosphorus Release,
W87-02737 5D

Anaerobic Treatment of Coke Plant Waste Water,
W87-02783 5D

Method for Determining Virus Inactivation During Sludge Treatment Processes,
W87-02898 5A

Effect of Effluent Recirculation on the Performance of a Two Stage Anaerobic Process,
W87-03088 5D

ANALOG COMPUTERS
New Analogue Computer for the Study of Pumping Tests under Falling Water-Table Conditions,
W87-02854 7B

ANALYTICAL METHODS
New Procedure for Extraction of Ammonium from Natural Waters for 15N Isotopic Ratio Determinations,
W87-02902 5A

ANEROBIC DIGESTION
Effects of Chloroform Toxicity on Methane Fermentation,
W87-02704 5D

Effects of Cyanide on the Methanogenic Degradation of Phenolic Compounds,
W87-02709 5D

Fundamentals of Anaerobic Digestion of Wastewater Sludges,
W87-02884 5D

ANIONIC SURFACTANTS
Indirect Atomic Absorption Determination of Anionic Surfactants in Wastewaters by Flow Injection Continuous Liquid-Liquid Extraction,
W87-03048 5A

ANKISTRODESMUS
Toxicity of Brass Dust to the Microalgae Ankistrodesmus falcatus and Selenastrum capricornutum,
W87-02778 5C

ANNUAL EVENTS
Extreme Value Theory Based on the r Largest Annual Events,
W87-03069 2L

ANOXIA
Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-03009 2I

ANTHESIS
Kleingrass Yield and Quality Under Three Irrigation Regimes When Harvested at Anthesis,
W87-02993 3F

ANTIFOULING PAINTS
Decline of the Gastropod Nucella lapillus Around South-West England: Evidence for the Effect of Tributyltin from Antifouling Paints,
W87-03053 5C

ANTIMONY
Study of Foamy Thermomineral Water of French Massif Central. II. Behavior of Some Trace Metals, Arsenic, Antimony and Germanium, (Etude des Eaux Thermominerales Carbogazeuses du Massif Central Francais. II. Comportement de Quelques Metaux en Trace, de l'Arsenic, de l'Antimoine et du Germanium),
W87-03146 2K

AOD PROCESS
Materials Technology for Turbine Performance,
W87-02687 8C

APPLE TREES
Effects of Frequency of Irrigation on Nutrient Uptake of Apple Trees,
W87-02875 3F

APPLEGATE DAM
Hydraulic Design of the Selective Withdrawal Structures of the Applegate Dam,
W87-03224 8A

APPLES
Effect of Rootstock on Apple (Malus domestica) Tree Water Relations,
W87-03056 2I

AQUATIC BACTERIA
R-Plasmid Transfer in Soil and Water,
W87-02792 5C

AQUATIC ENVIRONMENT
Microbial Polymers in the Aquatic Environment-I: Production by Activated Sludge Microorganisms under Different Conditions,
W87-02694 5D

Microbial Polymers in the Aquatic Environment-II: Isolation from Biologically Non-purified and Purified Municipal Waste Water and Analysis,
W87-02695 5D

Microbial Polymers in the Aquatic Environment-III: Isolation from River, Potable and Underground Water and Analysis,
W87-02696 5B

Classification of Macrophytes in Bodies of Water and of Aquatic Vegetation,
W87-02772 2H

Viable but Nonculturable Stage of Campylobacter jejuni and Its Role in Survival in the Natural Aquatic Environment,
W87-02899 5B

AQUATIC HABITATS
Morphological Features of Small Streams: Significance and Function,
W87-02931 4A

AQUATIC HYPHOMYCETES
Effects of Sulphide on Survival of Aero-Aquatic and Aquatic Hyphomycetes,
W87-03174 5C

AQUATIC PLANTS
Classification of Macrophytes in Bodies of Water and of Aquatic Vegetation,
W87-02772 2H

Macrophyte Growth in Shallow Streams: Field Investigations,
W87-02887 5C

AQUATIC WEED CONTROL
Pond Maintenance,
W87-03018 4A

AQUEDUCTS
Research Design for Tucson Aqueduct, Phase B Data Recovery,
W87-03328 6G

Supplemental Class III Archaeological Survey of the Phase A, Reach 3 Corridor, Tucson Aqueduct, Central Arizona Project: Late Sedentary and Early Classic Period Tucson Basin Hohokam Occupation in the Lower Santa Cruz Basin, Marana to Rillito, Arizona,
W87-03329 6G

AQUICLUDES
Groundwater Occurrences in the Hard Rock Terrains of Sri Lanka - A Case Study,
W87-03047 2F

AQUIFER SYSTEMS
Comparative Analysis of Transmissivity and Hydraulic Conductivity Values from the Ajali Aquifer System of Nigeria,
W87-02859 2F

Comparison of the Coupled Fresh Water-Salt Water Flow and the Ghyben-Herzberg Sharp Interface Approaches to Modeling of Transient Behavior in Coastal Aquifer Systems,
W87-03077 2F

AQUIFER TESTING
Comparative Analysis of Transmissivity and Hydraulic Conductivity Values from the Ajali Aquifer System of Nigeria,
W87-02859 2F

AQUIFERS
Response to Pumping of a Weathered-Fractured Granite Aquifer,
W87-02676 2F

High Concentration of Solutes at the Upper Part of the Saturated Zone (Water Table) of a Deep Aquifer Under Sewage-Irrigated Land,
W87-02677 2F

Retardation of Toxic Chemicals in a Contaminated Outwash Aquifer,
W87-02731 5B

In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-02754 5G

Aquifer Transmissivity of Porous Media from Resistivity Data,
W87-02837 7B

Mathematical Modelling for Multi-Aquifer Groundwater Basins,
W87-02848 2F

Morphology of a Saline Groundwater Body: Its Investigation, Description and Possible Explanation,
W87-02849 2F

Groundwater Occurrences in the Hard Rock Terrains of Sri Lanka - A Case Study,
W87-03047 2F

Upstream Weight Multiple-Cell Balance Finite-Element Method for Solving Three-Dimensional Convection-Dispersion Equations,
W87-03197 2F

ARABIA
Examination of the Mechanisms Controlling Groundwater Gradients in Hyper-Arid Regional Sedimentary Basins,
W87-02942 2F

ARCHAEOLOGY
Supplemental Class III Archaeological Survey of the Phase A, Reach 3 Corridor, Tucson Aqueduct, Central Arizona Project: Late Sedentary and Early Classic Period Tucson Basin Hohokam Occupation in the Lower Santa Cruz Basin, Marana to Rillito, Arizona,
W87-03329 6G

ARCTIC ZONE
Atmospheric Methane Sources: Alaskan Tundra Bogs, an Alpine Fen, and a Subarctic Boreal Marsh,
W87-02719 5B

ARID CLIMATE
Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. I. Soil Moisture, Water Relations, Tree and Fruit Growth,
W87-03110 3F

ARID CONDITIONS
Effect of Tillage and Mulching on Soil Environment and Cowpea Seedling Growth Under Arid Conditions,
W87-03166 3F

ARID LANDS
Examination of the Mechanisms Controlling Groundwater Gradients in Hyper-Arid Regional Sedimentary Basins,
W87-02942 2F

ARID ZONE
Review of Field Observations of Runoff Generation in the Tropics,
W87-02675 2E

ARIZONA
Late Quaternary Alluvial Stratigraphy of Whitewater Draw, Arizona: Implications for Regional Correlation of Fluvial Deposits in the American Southwest,
W87-03209 8E

ARKANSAS
Selective Withdrawal Needs for Lake Greeson Arkansas Intake Structure,
W87-03242 5G

ARSENIC
Health Effects of Arsenic in the Aqueous Environment,
W87-02833 5C

Bioaccumulation of Arsenic by Freshwater Algae and the Application to the Removal of Inorganic Arsenic from an Aqueous Phase: Part II. by Chlorella vulgaris Isolated from Arsenic-Polluted Environment,
W87-02907 5B

Effect of Metal Chelation on the Toxicity of Some Environmentally Hazardous Trace Metals to Daphnia magna,
W87-03024 5G

Arsenic Distributions in Porewaters and Sediments of Puget Sound, Lake Washington, the Washington Coast and Saanich Inlet, B.C.,
W87-03133 5B

Study of Foamy Thermomineral Water of French Massif Central. II. Behavior of Some Trace Metals, Arsenic, Antimony and Germanium, (Etude des Eaux Thermominerales Carbogazeuses du Massif Central Francais. II. Comportement de Quelques Metaux en Trace, de l'Arsenic, de l'Antimoine et du Germanium),
W87-03146 2K

ARTHROPODS
Impact of Chemically Contaminated Sewage Sludge on the Collard Arthropod Community,
W87-03081 5C

ARTIFICIAL LAKES
Study of Dissolved Oxygen Budgets in Natural and Artificial Lakes,
W87-02976 2H

ASBESTOS
Seasonal, Behavioral and Growth Changes of Juvenile Corbicula Fluminea Exposed to Chrysotile Asbestos,
W87-02699 5C

Asbestos in Potable Water Supplies and Attributable Risk of Gastrointestinal Cancer,
W87-02830 5C

Physiological Innocuity of Asbestos in Water,
W87-02831 5C

ASSIMILATION RATE
Growth and Yield of Sunflower and Soybean Under Soil Water Deficits,
W87-02992 2I

ASWAN HIGH DAM
General Impact of Aswan High Dam,
W87-03066 6G

ATHENS
Detection of Indigenous Enteric Viruses in Raw Sewage Effluents of the City of Athens, Greece, during a Two Year Survey,
W87-02659 5B

ATLANTIC OCEAN
Organic and Trace Metal Levels in Ocean Quahog, Arctica islandica Linne, from the Northwestern Atlantic,
W87-02759 5B

ATOMIC ABSORPTION SPECTROSCOPY
Possibilities of Improving the Determination of Extremely Low Lead Concentrations in Marine Fish by Graphite Furnace Atomic Absorption Spectrometry,
W87-02794 5A

Determination of Traces of Tin in Aqueous Matrices by Voltammetry and Atomic Absorption Spectrometry, (Bestimmung von Zinnspuren in wassrigen Matrices mit Voltammetrie und Atomabsorptionsspektrometrie),
W87-02796 5A

Multielement Trace Preconcentration from Water on Activated Carbon for the Sample Pretreatment for Atomic Spectroscopy (Flame-AAS, ICP/OES), (Multielement-Spurenanreicherung aus Wassern an Aktivkohle zur Probenvorbereitung fur die Atomspektroskopie (Flammen-AAS, ICP/OES)),
W87-02799 5A

Determination of Organically-associated Trace Metals in Estuarine Sea-Water by Solvent Extraction and Atomic-Absorption Spectrometry,
W87-03173 5A

AUSTRALIA
Evaporation from the Understorey in the Jarrah (Eucalyptus Marginata Don Ex Sm.) Forest, Southwestern Australia,
W87-02679 2D

Drought Policy in the U.S. and Australia: A Comparative Analysis,
W87-02937 6E

AUTOMATION
Automated Prevalve Dilution in Flow-Injection Analysis: The Automated Determination of Chloride in Surface, Ground and Domestic Water,
W87-02793 5A

Automation of a Chain of Run-of-River Power Stations,
W87-03035 8C

AVOIDANCE
Avoidance-Preference Reactions of Rainbow Trout (Salmo Gairdneri) After Prolonged Exposure to Chromium(VI),
W87-02698 5C

AZALEAS
Irrigation Scheduling Effects on Container Media and Canopy Temperatures and Growth of 'Hershey's Red' Azalea,
W87-03103 3F

BACKGROUND RADIATION
Drinking-Water Contribution to Natural Background Radiation,
W87-03084 5F

BACTERIA
Viruses and Bacteria in a Chalk Well,
W87-02655 5B

Bacteria and Viruses in Aerobically Digested Sludge: Influence of Physical and Chemical Treatments on Survival and Association with Flocs under Laboratory Conditions,
W87-02660 5D

Polyphosphate Kinase Activity during Phosphate Uptake by Bacteria,
W87-02736 5D

Interaction of Different Groups of Micro-Organisms in Biological Phosphate Removal,
W87-02739 5D

New Strategies for the Isolation of Microorganisms Responsible for Phosphate Accumulation,
W87-02740 5D

Importance of the Acidogenic Microflora in Biological Phosphorus Removal,
W87-02749 5D

Orthanilic Acid and Analogues as Carbon Sources for Bacteria: Growth Physiology and Enzymic Desulphonation,
W87-02781 5D

R-Plasmid Transfer in Soil and Water,
W87-02792 5C

Salmonellae and Pollution Indicator Bacteria in Municipal and Food Processing Effluents and the Cornwallis River,
W87-02815 5D

Bacteria Associated with Granular Activated Carbon Particles in Drinking Water,
W87-02891 5B

BACTERIAL ANALYSIS
Growth of Salmonellas in Different Enrichment Media,
W87-02786 5A

Comparison of Clark's Presence-Absence Test and the Membrane Filter Method for Coliform Detection in Potable Water Samples,
W87-02892 5A

Phenotypic Characteristics of Coliform and Noncoliform Bacteria from a Public Water Supply Compared with Regional and National Clinical Species,
W87-02894 5A

BACTERIAL PHYSIOLOGY
Some Physiological Characteristics of Acinetobacter spp. Accumulating Large Amounts of Phosphate,
W87-02742 5D

Role of Bacterial Phosphate Metabolism in Enhanced Phosphorus Removal from the Activated Sludge Process,
W87-02743 5D

Aut-Ecological Study of Acinetobacter in Activated Sludge,
W87-02744 5D

Orthanilic Acid and Analogues as Carbon Sources for Bacteria: Growth Physiology and Enzymic Desulphonation,
W87-02781 5D

BACTERIOPHAGE
Behaviour of Coliphages in Oxidation Ponds,
W87-02666 5D

BANK EROSION
Designing for Dynamic Equilibrium in Streams,
W87-02929 2E

BANK PROTECTION
Environmental Designs for Streambank Protection Projects,
W87-02621 6G

BARLEY
Manurial Value of Septic-Tank Sludge on Grassland,
W87-03102 5E

Nonpoint Source Loading of Phenolic Acids from Decomposing Crop Residue,
W87-03161 5B

BASALTS
Results of Pumping Tests in the Deccan Trap Basalts of Central India,
W87-03076 2F

BASINS
Denudation of the Piceance Creek Basin, Colorado,
W87-03289 2J

Chemical Mass Balance of a Small Basin in a Wet Monsoonal Environment and the Effect of Fast-Growing Plantation Forest,
W87-03291 2H

BASS
Primary and Secondary Stress Responses of Striped Bass (Morone saxatilis) Exposed to Benzene,
W87-02771 5C

BAVARIA
Heavy Metal Content in Sediments of Lakes in Southern Bavaria as a Sign of Long-Term Environmental Impact,
W87-03305 5C

BAYESIAN METHOD
Location of an Interface Observation Well: A Bayesian Approach,
W87-03187 2F

BEACHES
Sanitary Study of Surface Water and of the Beach of a Water Sports and Leisure Complex,
W87-02777 5B

BEANS
Triadimefon Protects Bean Plants from Water Stress through its Effects on Abscisic Acid,
W87-03202 2I

BED DEGRADATION
Fluvial Processes and Morphological Thresholds in Incised Channel Restoration,
W87-02930 2J

BEDROCK
Weathering Reactions, Water Chemistry and Denudation Rates in Drainage Basins of Different Bedrock Types: I - Sandstone and Shale,
W87-03288 2K

BEECH FORK LAKE
Selective Experiences: Alias Withdrawal Pains,
W87-03246 6B

BEEF CATTLE
Evaluation of Effluent from Grass Silage as a Feed for Beef Cattle Offered Silage-based Diets,
W87-03099 5E

BEETS
Responses of Sugarbeet to Deficit, High-Frequency Sprinkler Irrigation. I. Sucrose Accumulation, and Top and Root Dry Matter Production,
W87-02985 3F

Responses of Sugarbeet to Deficit, High-Frequency Sprinkler Irrigation. II. Sugarbeet Development and Partitioning to Root Growth,
W87-02986 3F

BEHAVIOR
Exposure to Fluoridated Public Water Supplies and Child Health and Behaviour,
W87-03092 5C

BENTHIC ENVIRONMENT
Benthic Fluxes of Cadmium, Copper, Nickel, Zinc and Lead in the Coastal Environment,
W87-03144 5B

BENTHIC FAUNA
Distribution of Benthic Macroinvertebrates in a Stream Exposed to Urban Runoff,
W87-02939 5C

BENZENE
Primary and Secondary Stress Responses of Striped Bass (Morone saxatilis) Exposed to Benzene,
W87-02771 5C

BERMUDA
Dissolved Organic Matter in Anoxic Pore Waters from Mangrove Lake, Bermuda,
W87-03136 5A

BERMUDAGRASS
Resistance of Plant Roots to Water Loss,
W87-03005 2I

BERRY'S CREEK
Control of the Methylation Process in a Mercury-polluted Aquatic Sediment,
W87-02584 5B

BERYLLIUM
Partitioning of 7 Beryllium in Fresh Water,
W87-03142 5A

BINDING
Anomalous Binding of Organic Contaminants May Be Artifactual Due to Radiochemical Impurities,
W87-02700 5A

BIO-ENGINEERING
Stream Improvements and Fish Response: A Bio-engineering Assessment,
W87-02932 4A

BIOACCUMULATION
Bioaccumulation of Arsenic by Freshwater Algae and the Application to the Removal of Inorganic Arsenic from an Aqueous Phase: Part II. by Chlorella vulgaris Isolated from Arsenic-Polluted Environment,
W87-02907 5B

Liquid Chromatographic Determination of Fluridone Aquatic Herbicide and Its Metabolite in Fish and Crayfish,
W87-03113 5A

Characterization of Sediment Contamination Utilizing Bioassay/Biaccumulation Testing,
W87-03255 5B

BIOASSAY
Toxicity Tests of Aquatic Pollutants by Using Common Duckweed,
W87-02582 5A

Effect of Metal Chelation on the Toxicity of Some Environmentally Hazardous Trace Metals to Daphnia magna,
W87-03024 5G

Characterization of Sediment Contamination Utilizing Bioassay/Biaccumulation Testing,
W87-03255 5B

BIODEGRADABILITY
Fundamentals of Anaerobic Digestion of Wastewater Sludges,
W87-02884 5D

BIODEGRADATION
Biodegradation of Methanol and Tertiary Butyl Alcohol in Subsurface Systems,
W87-02732 5B

Readily Biodegradable Fraction of Sewage: Its Influence on Phosphorus Removal and Measurement,
W87-02738 5D

In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-02754 5G

BIODEGREDATION
Effects of Cyanide on the Methanogenic Degradation of Phenolic Compounds,
W87-02709 5D

BIOFILM
Effect of Seawater on Nitrification by Attached Biofilm,
W87-02603 5D

BIOINDICATORS
Chione (Austrovenus) stutchburyi, a New Zealand Cockle, as a Bio-indicator for Lead Pollution,
W87-02586 5A

Metal Concentrations in the Annual Shell Layers of the Bivalve Elliptio complanata,
W87-02764 5B

Salmonellae and Pollution Indicator Bacteria in Municipal and Food Processing Effluents and the Cornwallis River,
W87-02815 5D

Practical Direct Plaque Assay for Coliphages in 100-ml Samples of Drinking Water,
W87-02890 5A

Effect of Organotins on Fecal Pollution Indicator Organisms,
W87-02901 5C

Distribution of Benthic Macroinvertebrates in a Stream Exposed to Urban Runoff,
W87-02939 5C

Decline of the Gastropod Nucella lapillus Around South-West England: Evidence for the Effect of Tributyltin from Antifouling Paints,
W87-03053 5C

Test of a Proposed Organizational Framework for the Ordering of Algal Toxicity Responses,
W87-03205 5C

Mussel Watch Program/Monitoring the Long-Term Effects of Dredged Material Disposal in New England Waters,
W87-03270 5B

BIOLOGICAL TREATMENT
Interaction of Different Groups of Micro-Organisms in Biological Phosphate Removal,
W87-02739 5D

Exchange of Organics, Phosphate and Cations between Sludge and Water in Biological Phosphorus and Nitrogen Removal Processes,
W87-02745 5D

Biological Phosphorus Removal in Combination with Simultaneous Precipitation,
W87-02746 5D

Factors Affecting Biological Removal of Phosphorus,
W87-02748 5D

Importance of the Acidogenic Microflora in Biological Phosphorus Removal,
W87-02749 5D

Biological Phosphorus and Nitrogen Removal at an Experimental Full Scale Plant in the U.K.,
W87-02750 5D

In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-02754 5G

Identification of Promising Concepts for Treatment of Contaminated Sediments,
W87-03256 5D

BIOLOGICAL WASTEWATER TREATMENT
Effect of Seawater on Nitrification by Attached Biofilm,
W87-02603 5D

Behaviour of Intracellular Polyphosphate in the Biological Phosphate Removal Process,
W87-02735 5D

Biological Phosphorus Removal in Combination with Simultaneous Precipitation,
W87-02746 5D

Biological Phosphorus Removal: A Technology Evaluation,
W87-02820 5D

Single-sludge Nitrogen Removal: Modeling and Experimental Results,
W87-02823 5D

BIOMASS
Interactive Algorithm for the Parameter Estimation of Complex Systems and Its Application to an Ecological Modelling of an Actual Japanese Lake,
W87-02600 2H

Three-dimensional Water-Quality-Transport Model Compared with Field Observations,
W87-02970 2H

Biomass and Structure of a Spartina alterniflora Loisel.-dominated Salt Marsh in France,
W87-03203 2L

BIOMASS MODELS
Macrophyte Growth in Shallow Streams: Biomass Model,
W87-02888 5C

BLAGDON LAKE
Influence of Catastrophic Floods on Water Quality as Recorded in the Sediments of Blagdon Lake, England,
W87-03306 2H

BLENDING
Blending in a Single Wet Well,
W87-03236 5G

BLOOMINGTON DAM
Bloomington Dam, Potomac River Water Quality Outlet,
W87-03231 5G

BLOOMINGTON LAKE
Hydraulic Design: Bloomington Lake and F. E. Walter Dam Project's Selective Withdrawal Structures,
W87-03233 8A

BLUE ICE LAKES
Placers of Cosmic Dust in the Blue Ice Lakes of Greenland,
W87-02913 2C

BLUFF BODIES
Evolution of a Single Wake Behind a Pair of Bluff Bodies,
W87-02862 2E

BOGS
Atmospheric Methane Sources: Alaskan Tundra Bogs, an Alpine Fen, and a Subarctic Boreal Marsh,
W87-02719 5B

Vegetation of the Low-Shrub Bogs of Northern New Jersey and Adjacent New York: Ecosystems at their Southern Limit,
W87-03208 2H

BOREHOLES
Borehole Television for Geotechnical Investigations,
W87-03032 7B

BORON
Boron Tolerance and Accumulation in the Duckweed, Lemna minor,
W87-03152 5C

Micronutrient Tolerance and Accumulation in the Duckweed, Lemna,
W87-03153 5C

BOTSWANA
Analysis of Earth-Tide-Induced Groundwater Flow in Eastern Botswana,
W87-02840 2F

BOTTOM SEDIMENTS
Management of Bottom Sediments Containing Toxic Substances.
W87-03248 5G

Model of Nitrogen Release from Bottom Sediments,
W87-03250 5B

Dewatering of Bottom Sediments,
W87-03261 2J

BOUNDARY CONDITIONS
Drains as a Boundary Condition in Finite Elements,
W87-03201 2F

BOUNDARY LAYERS
Analysis of the Velocity Field in a Boundary Layer Generated by a Water Wave, (Analyse du Champ des Vitesses dans la Couche Limite Generee par une Onde Progressive (Houle)),
W87-02790 8B

BOX MODELS
Box Model for Prediction of Water Quality in Eutrophic Lakes,
W87-02972 2H

BRASS DUST
Toxicity of Brass Dust to the Microalgae Ankistrodesmus falcatus and Selenastrum capricornutum,
W87-02778 5C

BREAKWATERS
Computation of Wave Transmission Over a Shore Protecting Submerged Breakwater,
W87-03217 8B

BRISTOL CHANNEL
Seasonal Abundance, Growth, Feeding and Age Composition of Flounder (Platichthys flesus (L.)) Populations of the Severn Estuary and Bristol Channel,
W87-03027 2L

BRITISH COLUMBIA
Arsenic Distributions in Porewaters and Sediments of Puget Sound, Lake Washington, the Washington Coast and Saanich Inlet, B.C.,
W87-03133 5B

BUILDING CODES
Snow Loads in the 1985 National Building Code of Canada: Curved Roofs,
W87-02667 2C

BULB TURBINES
65 MW Bulb Turbine for Japan's Tadami Project,
W87-02691 8C

BULK DENSITY
Physical Environment Near the Surface of Plowed and No-Tilled Soils,
W87-03171 2G

BUOYANCY
Experiments on Vertical Plane Buoyant Jets in Shallow Water,
W87-02762 8B

Effect of Waves on Buoyant Jets,
W87-02964 5B

BURNSVILLE LAKE
Selective Experiences: Alias Withdrawal Pains,
W87-03246 6B

CADMIUM
Determination of Lead, Cadmium and Thallium in Water Samples at ppb and ppt Levels by Isotope Dilution Mass Spectrometry, (Bestimmung von Blei, Cadmium und Thallium in Wasserproben im ppb- und ppt-Bereich durch massenspektrometrische Isotopenverdunnungsanalyse),
W87-02795 5A

Direct Determination of Cd, Cu and Ni in the Elbe River Estuary with Zeeman AAS and Matrix Modification (Direktbestimmung von Cd, Cu and Ni im Elbeastuar mit Hilfe der Zeeman-Atomabsorptionsspektroskopie und Matrixmodifikation),
W87-03087 5A

Interlaboratory Comparison of Analyses for Heavy Metals in Clam Tissue,
W87-03114 5A

Flame Absorption Spectroscopic Determination of Cadmium, Copper, Iron, Lead, and Zinc in Mussels,
W87-03115 5A

Early Diagenesis of Cadmium and Cobalt in Sediments of the Laurentian Trough,
W87-03138 5B

Benthic Fluxes of Cadmium, Copper, Nickel, Zinc and Lead in the Coastal Environment,
W87-03144 5B

Determination of Organically-associated Trace Metals in Estuarine Sea-Water by Solvent Extraction and Atomic-Absorption Spectrometry,
W87-03173 5A

CALCIUM
Water Sorption Characteristics of Aluminum- and Calcium-Saturated Soil Clays,
W87-02728 2G

Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. II. Mineral Composition of Fruit and Leaves, Fruit Disorders, and Fruit Set,
W87-03111 3F

Salt Responses of Lettuce to Salinity. II. Effect of Calcium on Growth and Mineral Status,
W87-03155 5C

CALIFORNIA
Models for Water and Power Scheduling for the California State Water Project,
W87-02626 6A

Hydrogen Isotope Study of Large-Scale Meteoric Water Transport in Northern California and Nevada,
W87-02686 2F

Patterns in Distribution and Abundance of a Noncoevolved Assemblage of Estuarine Fishes in California,
W87-02758 2L

Estimating Snow Load in California for Three Recurrence Intervals,
W87-03336 2C

CAMPYLOBACTER
Viable but Nonculturable Stage of Campylobacter jejuni and Its Role in Survival in the Natural Aquatic Environment,
W87-02899 5B

CANADA
Estimation of Wastewater Treatment Costs: Evaluation of the CAPDET Model for Canadian Conditions,
W87-02670 5D

Halogenated Phenols in Water at Forty Canadian Potable Water Treatment Facilities,
W87-03112 5F

CANOPY PARAMETERS
Remote Sensing Techniques for Assessing Water Deficits and Modeling Crop Response,
W87-02953 7B

CAPACITANCE
Effect of Rootstock on Apple (Malus domestica) Tree Water Relations,
W87-03056 2I

CAPE COD
Impacts from Mosquito Control-Induced Sulphur Mobilization in a Cape Cod Estuary,
W87-03127 5C

CAPILLARY EVAPORIMETERS
Evaporation Data from a Capillary Evaporimeter,
W87-03073 7B

CAPPING
Effectiveness of Capping in Isolating Dutch Kills Sediment from Biota and the Overlying Water,
W87-03332 5G

CARBON CYCLE
Orthanilic Acid and Analogues as Carbon Sources for Bacteria: Growth Physiology and Enzymic Desulphonation,
W87-02781 5D

CARBON DIOXIDE
Effects of Carbon Dioxide Enrichment and Soil Water on Maize,
W87-03002 2I

Biogenic Methane Formation in Marine and Freshwater Environments: CO2 Reduction vs. Acetate Fermentation-Isotope Evidence,
W87-03137 5B

Study of Foamy Thermomineral Water of French Massif Central. II. Behavior of Some Trace Metals, Arsenic, Antimony and Germanium, (Etude des Eaux Thermominerales Carbogazeuses du Massif Central Francais. II. Comportement de Quelques Metaux en Trace, de l'Arsenic, de l'Antimoine et du Germanium),
W87-03146 2K

CARBON RADIOISOTOPES
Tritium Corrected 14C and Atmospheric Noble Gas Corrected 4He Applied to Deduce Ages of Mixed Groundwaters: Examples from the Baden Region, Switzerland,
W87-03147 5A

Primary Productivity (C14) at Twin Lakes Colorado: 1973-81 Study Results,
W87-03326 2H

CARBONATE ROCKS
Restoration of Pipe Drainage in Foundations of Hydraulic Structures on Carbonate Rocks,
W87-03184 8A

CATCHMENT AREAS
Modeling North Cascades Annual Runoff Distribution Using Drainage Basin Elevation Distribution,
W87-02627 2E

Characterization of Water Using Combined Sewer Overflows, (Caracterization des Eaux Usees de Debordements de Reseau Unitaire),
W87-02672 5B

Classification of Drainage Basins According to their Physical Characteristics; An Application for Flood Frequency Analysis in Scotland,
W87-02683 2E

Real-Time Kinematic Catchment Model for Hydro Operation,
W87-02766 2E

Hydrological Investigations of Dinaric Karst at the Krcic Catchment and the River Krka Springs (Yugoslavia),
W87-02845 2A

Determination of Rainfall Excess on Spatially Variable Catchments,
W87-02853 2A

Basin-wide Ecological Fate Model for Management of Chemicals Hazard,
W87-02975 5B

Changes in Catchment Runoff Following Drainage and Afforestation,
W87-03072 4C

Mechanisms of Dissolved Solids Transport in Flysch Drainage Basins,
W87-03281 5B

Weathering Reactions, Water Chemistry and Denudation Rates in Drainage Basins of Different Bedrock Types: I - Sandstone and Shale,
W87-03288 2K

Biogeochemical Controls on River Water Quality in a Forested Drainage Basin, Warwickshire, UK,
W87-03292 2E

Chemical Erosion Measurements in the Massif des Maures: The Example of the Rimbaud Drainage Basin (Var, France)(Mesures de l'Erosion Chimique dans le Massif des Maures: l'Exemple du Basin Versant du Rimbaud (Var, France)),
W87-03294 2K

Numerical Simulation Relating Land Uses Within a Drainage Basin to the Downstream River Water Quality (Simulation Numerique de l'Influence des Pratiques Culturales dans un BAsin Versant sur la Qualite des Eaux a Son Exutoire),
W87-03300 6G

Comparison of Water Quality in Drainage Basins Under Agricultural and Forest Land Use,
W87-03307 2E

CATCHMENT BASINS
Runoff Processes and Dissolved Substances During Flood Events in Small Differently Used Drainage Areas,
W87-03283 2E

Stream Solute Sources and Variations in a Temperate Granite Drainage Basin,
W87-03296 5B

CATCHMENT SIZE
Effect of Catchment Size on Phosphorus Export,
W87-02941 5B

CATIONS
Exchange of Organics, Phosphate and Cations between Sludge and Water in Biological Phosphorus and Nitrogen Removal Processes,
W87-02745 5D

CAVITATION
Materials Technology for Turbine Performance,
W87-02687 8C

CEBEL MODEL
Water-hammer Diagnostic Established by A Numerical Method, (Un Diagnostic de Coup de Belier Etabli par Modele Numerique),
W87-02577 8C

CEMENTS
Lime-Cement Hardening of Very Soft Freshwater Clay,
W87-03260 8D

CENTRIFUGATION
Detection of Hepatitis A Virus in Drinking Water by Enzyme-Immunoassay Using Ultracentrifugation for Virus Concentration,
W87-02647 5A

CESSPOOLS
Wastewater Engineering Design for Unsewered Areas,
W87-03339 5E

CHALK
Viruses and Bacteria in a Chalk Well,
W87-02655 5B

CHAMPAGNEUX
Energy Recovery Small Hydro Plants on the Rhone River. The First Months of Operation of Champagneux Power Plant and the Sault-Brenaz Project, (Les Petites Centrales de Recuperation sur le Rhone. Les Premiers Mois d' Exploitation de la Centrale de Champagneux et le Project de Sault-Brenaz),
W87-02575 8C

CHANNEL EROSION
Fluvial Processes and Morphological Thresholds in Incised Channel Restoration,
W87-02930 2J

Morphological Features of Small Streams: Significance and Function,
W87-02931 4A

CHANNEL EVOLUTION MODELS
Fluvial Processes and Morphological Thresholds in Incised Channel Restoration,
W87-02930 2J

CHANNEL FLOW
Direct Solutions for Normal Depth Using the Manning Equation,
W87-02963 2E

CHANNEL HYDRAULICS
Stability of Flows in Channels with Small Wall Curvature,
W87-02863 8B

CHANNEL MORPHOLOGY
Stability of Flows in Channels with Small Wall Curvature,
W87-02863 8B

Fluvial Processes and Morphological Thresholds in Incised Channel Restoration,
W87-02930 2J

Morphological Features of Small Streams: Significance and Function,
W87-02931 4A

CHANNEL REHABILITATION
Fluvial Processes and Morphological Thresholds in Incised Channel Restoration,
W87-02930 2J

CHANNELFLOW
Stability of Flows in Channels with Small Wall Curvature,
W87-02863 8B

CHARCOAL ROT
Effect of Tillage and Mulching on Soil Environment and Cowpea Seedling Growth Under Arid Conditions,
W87-03166 3F

CHELATION
Effect of Metal Chelation on the Toxicity of Some Environmentally Hazardous Trace Metals to Daphnia magna,
W87-03024 5G

CHEMICAL ANALYSIS
Contaminating Peptides Widely Present in Ion-Exchanged Water, Reagents, Experimental Implements and Natural Sample,
W87-02787 5B

Automated Prevalve Dilution in Flow-Injection Analysis: The Automated Determination of Chloride in Surface, Ground and Domestic Water,
W87-02793 5A

Possibilities of Improving the Determination of Extremely Low Lead Concentrations in Marine Fish by Graphite Furnace Atomic Absorption Spectrometry,
W87-02794 5A

Determination of Lead, Cadmium and Thallium in Water Samples at ppb and ppt Levels by Isotope Dilution Mass Spectrometry, (Bestimmung von Blei, Cadmium und Thallium in Wasserproben im ppb- und ppt-Bereich durch massenspektrometrische Isotopenverdunnungsanalyse),
W87-02795 5A

Determination of Traces of Tin in Aqueous Matrices by Voltammetry and Atomic Absorption Spectrometry, (Bestimmung von Zinnspuren in wassrigen Matrices mit Voltammetrie und Atomabsorptionsspektrometrie),
W87-02796 5A

Trace Determination of Chromium in Various Water Types by Adsorption Differential Pulse Voltammetry,
W87-02797 5A

Flow Injection Analysis of Chloride in Tap and Sewage Water Using Ion-Selective Electrode Detection,
W87-02798 5A

Multielement Trace Preconcentration from Water on Activated Carbon for the Sample Pretreatment for Atomic Spectroscopy (Flame-AAS, ICP/OES), (Multielement-Spurenanreicherung aus Wassern an Aktivkohle zur Probenvorbereitung fur die Atomspektroskopie (Flammen-AAS, ICP/OES)),
W87-02799 5A

Studies on Sediments of the River Lahn: 1. Analytical Results, (Untersuchungen an Lahnsedimenten: 1. Analytische Ergebnisse),
W87-02800 5B

Selective Preconcentration of Copper from Aqueous Solution by Using Kerateine Gel,
W87-02802 5A

Investigations on the Application of the Ion-Exchanger SRAFION NMRR for the Enrichment and Separation of Uranium and Other Trace Elements from Sea Water, (Untersuchungen uber die Verwendbarkeit des Ionenaustauschers SRAFION NMRR zur Anreicherung und Abtrennung von Uran und anderen Spurenelementen aus dem Meerwasser),
W87-02803 5A

Preservation of Traces of Chromium(VI) in Water and Waste Water Samples,
W87-02804 5A

Indirect Atomic Absorption Determination of Anionic Surfactants in Wastewaters by Flow Injection Continuous Liquid-Liquid Extraction,
W87-03048 5A

Liquid Chromatographic Determination of Fluridone Aquatic Herbicide and Its Metabolite in Fish and Crayfish,
W87-03113 5A

Chemical Control of Soluble Phosphorus in the Amazon Estuary,
W87-03139 5B

Study on Chemical Behavior Between Sediment and Upper Water,
W87-03251 2J

Factors Controlling the Chemical Composition of River Waters of India,
W87-03285 2E

Weathering Reactions, Water Chemistry and Denudation Rates in Drainage Basins of Different Bedrock Types: I - Sandstone and Shale,
W87-03288 2K

CHEMICAL COMPOSITION
Effects of Light on Growth, RuBPCase Activity and Chemical Composition of Ulva Species (Chlorophyta),
W87-02809 2L

Influence of Climatic Factors and Forage Age on the Chemical Components of Ryegrass Related to Grass Tetany,
W87-02980 2I

CHEMICAL EROSION
Chemical Erosion Measurements in the Massif des Maures: The Example of the Rimbaud Drainage Basin (Var, France)(Mesures de l'Erosion Chimique dans le Massif des Maures: l'Exemple du Basin Versant du Rimbaud (Var, France)),
W87-03294 2K

CHEMICAL MASS BALANCE
Chemical Mass Balance of a Small Basin in a Wet Monsoonal Environment and the Effect of Fast-Growing Plantation Forest,
W87-03291 2H

CHEMICAL OXYGEN DEMAND
Effect of Effluent Recirculation on the Performance of a Two Stage Anaerobic Process,
W87-03088 5D

CHEMICAL PROPERTIES
Determination of Pollution and Eutrophic Conditions of Sapanca Lake (Turkey),
W87-02587 5B

Interactions between Biotic and Abiotic Factors and Viruses in a Water System,
W87-02657 5B

Studies on Sediments of the River Lahn: 2. Chemometric Evaluation, (Untersuchungen an Lahnsedimenten: 2. Chemometrische Auswertung),
W87-02801 5B

Evolution in Space and Time of an Alluvial Aquifer under the Effect of an Exceptional Multi-Year Drought (Mediterranean Shore, Herault, France) (Evolution Spatio-Temporelle d'un Aquifere Alluvial sous l'Effet d'une Secheresse Pluriannuelle Exceptionnelle (Littoral Mediterraneen, Herault, France)),
W87-02838 2F

Morphology of a Saline Groundwater Body: Its Investigation, Description and Possible Explanation,
W87-02849 2F

CHEMICAL TREATMENT
Identification of Promising Concepts for Treatment of Contaminated Sediments,
W87-03256 5D

CHEMICAL WASTES
Basin-wide Ecological Fate Model for Management of Chemicals Hazard,
W87-02975 5B

CHEMISTRY OF PRECIPITATION
Composition of Precipitation Water and Its Acidity,
W87-02721 5B

Study of Acid Deposition in Switzerland: Temporal Variation in the Ionic Composition of Wet Precipitation at Rural Sites During 1983-1984,
W87-02763 5B

Measurements of pH versus Drop Size in Natural Rain,
W87-02811 2B

Temporal Evolution of Nitrogen Compounds in Swedish Precipitation Since 1955,
W87-02812 2B

CHILD HEALTH
Exposure to Fluoridated Public Water Supplies and Child Health and Behaviour,
W87-03092 5C

CHILDREN
Need for Fluoridation of Desalinated Water Supplies,
W87-03041 5F

CHINA
Performance of China's First Concrete Cut-off Wall,
W87-02689 8A

CHINOOK
Effect of Standing Small Grain Stubble on Snow Cover Characteristics in Alternate Fallow Strip Cropping,
W87-02990 2C

CHLORIDES
Automated Prevalve Dilution in Flow-Injection Analysis: The Automated Determination of Chloride in Surface, Ground and Domestic Water,
W87-02793 5A

Flow Injection Analysis of Chloride in Tap and Sewage Water Using Ion-Selective Electrode Detection,
W87-02798 5A

CHLORINATED HYDROCARBONS
Levels of Chlorinated Hydrocarbons and Composition of PCB in Herring Gull Larus argentatus Eggs Collected in Norway in 1969 Compared to 1979-81,
W87-02585 5B

CHLORINATION
Trihalomethane Levels in Chlorinated Michigan Drinking Water,
W87-02605 5F

Chlorination to Prevent and Control Waterborne Diseases,
W87-02613 5F

Electrofocusing of Viruses and Sensitivity to Disinfection,
W87-02664 5D

Water Supply of Varanasi - The Oldest City of India,
W87-03039 5F

CHLORINE
Root Control of Leaf Phosphorus and Chlorine Accumulation in Soybean Under Salinity Stress,
W87-02984 2I

CHLORINE ISOTOPES
137C-135C Variations in a Diffusion-Controlled Groundwater System,
W87-03149 5A

CHLOROMETHANES
Radiation Induced Decomposition of Some Chlorinated Methanes in Water,
W87-02702 5D

CHLOROPHYLL
Modelling of the Lower Trophic Levels of a Marine Ecosystem and Its Example of Short-period Variations of Chlorophyll and Nutrient in Harima-Nada,
W87-02601 2L

CHLOROPHYTA
Toxicity of Brass Dust to the Microalgae Ankistrodesmus falcatus and Selenastrum capricornutum,
W87-02778 5C

Effects of Light on Growth, RuBPCase Activity and Chemical Composition of Ulva Species (Chlorophyta),
W87-02809 2L

CHROMIUM
Avoidance-Preference Reactions of Rainbow Trout (Salmo Gairdneri) After Prolonged Exposure to Chromium(VI),
W87-02698 5C

Trace Determination of Chromium in Various Water Types by Adsorption Differential Pulse Voltammetry,
W87-02797 5A

Preservation of Traces of Chromium(VI) in Water and Waste Water Samples,
W87-02804 5A

Spectrophotometric Determination of Chromium in Waste Water and Soil,
W87-03052 5A

CHRYSOTILE ASBESTOS
Seasonal, Behavioral and Growth Changes of Juvenile Corbicula Fluminea Exposed to Chrysotile Asbestos,
W87-02699 5C

CHUBB/BAUMAN METHOD
Chubb/Bauman Method for Estimating the Recreation Potential of Rivers: A Critical Review,
W87-02634 6A

CHUNCHEON
Water Use in Urban Korea,
W87-02617 6D

CLAM TISSUES
Interlaboratory Comparison of Analyses for Heavy Metals in Clam Tissue,
W87-03114 5A

CLAMS
Seasonal, Behavioral and Growth Changes of Juvenile Corbicula Fluminea Exposed to Chrysotile Asbestos,
W87-02699 5C

Organic and Trace Metal Levels in Ocean Quahog, Arctica islandica Linne, from the Northwestern Atlantic,
W87-02759 5B

Metal Concentrations in the Annual Shell Layers of the Bivalve Elliptio complanata,
W87-02764 5B

CLARIFIERS
Hydraulics of Rectangular Clarifiers,
W87-02886 8B

CLASSICATION
Environmental Chemistry of Rainwater in Sri Lanka,
W87-03023 2B

CLASSIFICATION
Classification of Macrophytes in Bodies of Water and of Aquatic Vegetation,
W87-02772 2H

Characterization and Classification of Seaside-Salt-marsh Soils on Virginia's Eastern Shore,
W87-02919 2L

CLAYS
Hydrology of a Sloping, Structured Clay Soil at Wytham, Near Oxford, England,
W87-02685 2G

Water Sorption Characteristics of Aluminum- and Calcium-Saturated Soil Clays,
W87-02728 2G

Termination Criteria for Clay Permeability Testing,
W87-02788 2G

Lime-Cement Hardening of Very Soft Freshwater Clay,
W87-03260 8D

CLEANUP
Hazardout Waste Disposal: What Are the Options,
W87-03015 5E

Under EPA Scrutiny: Underground Storage Tanks,
W87-03021 5B

CLEANUP OPERATIONS
Petroleum Recovery Operations in an Urban Area,
W87-03065 5G

Environmental Conservation in the Port of Maizuru,
W87-03269 5B

CLEAR-CUTTING
Transport and Loss of Nitrous Oxide in Soil Water After Forest Clear-cutting,
W87-02912 5B

CLIMATE
Lessons from Field Experience with Rainwater Collection Systems in Africa and Asia,
W87-03042 5F

CLIMATE EFFECTS
Climatic Change, Weather Variability, and Corn Production,
W87-03006 2I

CLIMATIC CONDITIONS
Influence of Climatic Factors and Forage Age on the Chemical Components of Ryegrass Related to Grass Tetany,
W87-02980 2I

CLIMATIC DATA
Use of Climate Predictions to Decide a Water Management Problem,
W87-02633 6A

CLOSTRIDIUM
Membrane Filtration Enumeration of Faecal Clostridia and Clostridium Perfringens in Water,
W87-02701 5A

CLOUD SEEDING
Interim Progress Report, Volume I: SCPP Meteorological and Statistical Support for Period 1 September 1984 through 31 August 1985,
W87-03327 2B

CLOUDS
Response of Cloud Supersaturation to Radiative Forcing,
W87-03214 2B

CLUSTER ANALYSIS
Structuring of Ecological Data Sets by Methods of Correlation and Cluster Analysis,
W87-02597 2L

COAGULATION
Innovative Technique for Determining Velocity Gradient in Coagulation--Flocculation Process,
W87-02708 5F

COASTAL AQUIFERS
Simple Approximation for a Moving Interface in a Coastal Aquifer,
W87-02851 2F

Comparison of the Coupled Fresh Water-Salt Water Flow and the Ghyben-Herzberg Sharp Interface Approaches to Modeling of Transient Behavior in Coastal Aquifer Systems,
W87-03077 2F

COASTAL ENGINEERING
Computation of Wave Transmission Over a Shore Protecting Submerged Breakwater,
W87-03217 8B

COASTAL WATERS
Distribution of Anionic Surfactants in the Water Column of the Gulf of Fos-sur-Mer, (Distribution des Detergents Anioniques dans la Colonne d'Eau du Golfe de Fos-sur-Mer),
W87-02563 5B

Study on the Modelling of the Behavior of Phosphorus Released from Sediments,
W87-02967 2L

Benthic Fluxes of Cadmium, Copper, Nickel, Zinc and Lead in the Coastal Environment,
W87-03144 5B

COASTAL ZONE MANAGEMENT
Stemming the Loss of Coastal Wetland Habitats: Jamaica as a Model for Tropical Developing Countries,
W87-03128 2L

COBALT
Early Diagenesis of Cadmium and Cobalt in Sediments of the Laurentian Trough,
W87-03138 5B

Effect of Oxygen on Release and Uptake of Cobalt, Manganese, Iron and Phosphate at the Sediment-Water Interface,
W87-03143 5B

COCKSFOOT
Relationships Between Growth and Measured Weather Factors Among Contrasting Varieties of Lolium, Dactylis and Festuca Species,
W87-03100 2I

COCKSFOOT GRASS
Response to Waterlogging and Differing Sensitivity to Divalent Iron and Manganese in Clones of Dactylis glomerata L. Derived from Well-Drained and Poorly-Drained Soils,
W87-03095 5C

COGENERATION
Cogen System Fires 100% Untreated Digester Gas,
W87-03116 5D

COHESIVE SOILS
Method of Investigating the Compactibility of Cohesive Soils,
W87-02865 8D

COKE WASTES
Anaerobic Treatment of Coke Plant Waste Water,
W87-02783 5D

COLD REGIONS
Experience in Creating Mechanical Equipment for Northern Hydroelectric Stations,
W87-03178 8C

COLIFORM BACTERIA
Slow Sand Filtration: Influences of Selected Process Variables,
W87-02611 5F

COLIFORMS
Comparison of Clark's Presence-Absence Test and the Membrane Filter Method for Coliform Detection in Potable Water Samples,
W87-02892 5A

Phenotypic Characteristics of Coliform and Noncoliform Bacteria from a Public Water Supply Compared with Regional and National Clinical Species,
W87-02894 5A

COLIPHAGES
Practical Direct Plaque Assay for Coliphages in 100-ml Samples of Drinking Water,
W87-02890 5A

COLLARDS
Impact of Chemically Contaminated Sewage Sludge on the Collard Arthropod Community,
W87-03081 5C

COLLOCATION
Finite-Element Collocation Method for Variably Saturated Flow in Two Space Dimensions,
W87-03192 2F

COLORADO
Colorado v. New Mexico II: Judicial Restraint in the Equitable Apportionment of Interstate Waters,
W87-02595 6E

Primary Productivity (C14) at Twin Lakes Colorado: 1973-81 Study Results,
W87-03326 2H

COLORADO RIVER WATER CONSERVATION DISTRICT
Abstention: The Crooked Course of Colorado River,
W87-02596 6E

COLUMBIA RIVER
Complexity in Columbia River Systems Modeling,
W87-03059 6B

COMMON DOGWHELK
Decline of the Gastropod Nucella lapillus Around South-West England: Evidence for the Effect of Tributyltin from Antifouling Paints,
W87-03053 5C

COMPARISON STUDIES
Interlaboratory Comparison of Analyses for Heavy Metals in Clam Tissue,
W87-03114 5A

COMPRESSIBILITY
Two-Chamber Consolidation Press,
W87-03183 8D

COMPRESSIVE STRENGTH
Analysis of Methods of Determining the Compressive Strength of Rocks,
W87-03180 8E

COMPUTATION PROCEDURE
Computation of Hydraulic Transients in Complex Hydro Schemes,
W87-03036 8A

COMPUTER MODELS
Water-hammer Diagnostic Established by A Numerical Method, (Un Diagnostic de Coup de Belier Etabli par Modele Numerique),
W87-02577 8C

Models for Water and Power Scheduling for the California State Water Project,
W87-02626 6A

Modeling North Cascades Annual Runoff Distribution Using Drainage Basin Elevation Distribution,
W87-02627 2E

Comparison of MOBED and HEC-6 River Flow Models,
W87-02669 2E

Estimation of Wastewater Treatment Costs: Evaluation of the CAPDET Model for Canadian Conditions,
W87-02670 5D

Application of Computer Intensive Statistics to Parameter Uncertainty in Streamflow Synthesis,
W87-02945 2E

Complexity in Columbia River Systems Modeling,
W87-03059 6B

COMPUTER PROGRAMS
Analysis of Transient Phenomena in Hydroelectric Generation Plants, (Calcul des Transitoires dans les Installations Hydrauliques de Production d'Energie),
W87-02580 8C

Computerized Layout Generation for Sanitary Sewers,
W87-03062 8A

SELECT: The Numerical Model,
W87-03235 5G

COMPUTERS
Data Processing for Hydro Plant Control,
W87-03033 8C

Decision Support System for Local Water Management,
W87-03064 6D

Getting Your Money's Worth from Computer Based Control Systems - Part 1,
W87-03120 5D

CONCRETE TECHNOLOGY
RCC: A Dam Rehab Solution Unearthed,
W87-02770 8F

CONCRETE TESTING
Alkali-Silica Reactivity in Five Dams in Southwestern United States,
W87-03319 8F

CONCRETES
RCC: A Dam Rehab Solution Unearthed,
W87-02770 8F

Latex Admixtures for Portland Cement Concrete and Mortar,
W87-03318 8G

Alkali-Silica Reactivity in Five Dams in Southwestern United States,
W87-03319 8F

CONDUCTIVITY
HPLC Anion Exclusion Method for Fluoride Determinations in Complex Effluents,
W87-03094 5A

CONFERENCES
Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures.
W87-03221 8A

Proceedings of the Ohio Water Law Conference.
W87-03308 6E

Microbiology of Subsurface Environments.
W87-03325 2F

CONFINED AQUIFERS
Simple Approximation for a Moving Interface in a Coastal Aquifer,
W87-02851 2F

CONIDIA
Water or Salt Stress Increases Infectivity of Erysiphe pisi Conidia Taken from Stressed Plants,
W87-03175 5C

CONSERVATION TILLAGE
Response of Conservation Tillage Sorghum to Growing Season Precipitation,
W87-03167 3F

CONSOLIDATION PRESS
Two-Chamber Consolidation Press,
W87-03183 8D

CONSTRUCTION
Effective Technology of Constructing Earth Structures,
W87-02864 8A

Innovative Lagoon Liner Pays Off,
W87-03078 5D

Constructing a Better Environment,
W87-03126 5G

CONSTRUCTION COSTS
Creation of a Cross-Flow Turbines Range, (Creation d'une Gamme de Turbines a Flux Traversant),
W87-02569 8C

Adaptation of an Existing Sill for Installation of a Siphon Plant, (Adaptation d'un Seuil Existant pour l'Implantation d'un Groupe en Siphon),
W87-02574 8C

CONSTRUCTION MATERIALS
Materials Technology for Turbine Performance,
W87-02687 8C

CONSTRUCTION METHODS
Effective Technology of Constructing Earth Structures,
W87-02864 8A

Cordless Geo-Data Link,
W87-03031 7B

CONTAMINANT TRANSPORT MODELS
Field Validation of the Contaminant Transport Model, FEMA,
W87-03089 5B

CONTAMINATION
Retardation of Toxic Chemicals in a Contaminated Outwash Aquifer,
W87-02731 5B

Metal Concentrations in the Annual Shell Layers of the Bivalve Elliptio complanata,
W87-02764 5B

Contaminating Peptides Widely Present in Ion-Exchanged Water, Reagents, Experimental Implements and Natural Sample,
W87-02787 5B

Sources of Nitrate to Ground Water,
W87-03130 5B

CONTINUOUSLY STIRRED TANK REACTORS
Effect of Seawater on Nitrification by Attached Biofilm,
W87-02603 5D

CONTROL SYSTEMS
Data Processing for Hydro Plant Control,
W87-03033 8C

Automation of a Chain of Run-of-River Power Stations,
W87-03035 8C

CONTROLLED TRAFFIC
Effect of Deep Tillage and Controlled Traffic on Root Growth, Water-Use Efficiency and Yield of Irrigated Maize and Wheat,
W87-03165 3F

CONVECTION
Upstream Weight Multiple-Cell Balance Finite-Element Method for Solving Three-Dimensional Convection-Dispersion Equations,
W87-03197 2F

CONVECTIVE STORMS
Structure, Energetics and Propagation of Rotating Convective Storms. Part I: Energy Exchange with the Mean Flow,
W87-03215 2B

CONVENTIONAL TILLAGE MANAGEMENT
Nonpoint Source Loading of Phenolic Acids from Decomposing Crop Residue,
W87-03161 5B

COOLIDGE DAM
Alkali-Silica Reactivity in Five Dams in Southwestern United States,
W87-03319 8F

COOS BAY
Selection and Management of a New Orlean Dredged Material Disposal Site at Coos Bay, Oregon, USA, to Receive Contaminated Dredged Material,
W87-03263 5E

COPPER
Selective Preconcentration of Copper from Aqueous Solution by Using Kerateine Gel,
W87-02802 5A

Direct Determination of Cd, Cu and Ni in the Elbe River Estuary with Zeeman AAS and Matrix Modification (Direktbestimmung von Cd, Cu and Ni im Elbeastuar mit Hilfe der Zeeman-Atomabsorptionsspektroskopie und Matrixmodifikation),
W87-03087 5A

Interlaboratory Comparison of Analyses for Heavy Metals in Clam Tissue,
W87-03114 5A

Flame Absorption Spectroscopic Determination of Cadmium, Copper, Iron, Lead, and Zinc in Mussels,
W87-03115 5A

Benthic Fluxes of Cadmium, Copper, Nickel, Zinc and Lead in the Coastal Environment,
W87-03144 5B

Micronutrient Tolerance and Accumulation in the Duckweed, Lemna,
W87-03153 5C

Determination of Organically-associated Trace Metals in Estuarine Sea-Water by Solvent Extraction and Atomic-Absorption Spectrometry,
W87-03173 5A

CORK SPOT
Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. II. Mineral Composition of Fruit and Leaves, Fruit Disorders, and Fruit Set,
W87-03111 3F

CORN
Root Distribution and Water Uptake Patterns of Maize Cultivars Field-Grown under Differential Irrigation,
W87-02817 2I

Corn Yield Response to Irrigation, Plant Population and Nitrogen in a Cool, Humid Climate,
W87-02878 3F

Wheat Residue Management Effects on Soil Water Storage and Corn Production,
W87-02924 3F

Corn Irrigation Scheduling in Humid Regions on Sandy Soils with Tillage Pans,
W87-02981 3F

Soil Water Balance of Intercropped Maize and Cowpea Grown in a Tropical Hydromorphic Soil in Western Nigeria,
W87-02989 2I

Interactive Effects of Nitrogen and Water Stresses on Water Relations of Field-Grown Corn Leaves,
W87-02994 2I

Effects of Carbon Dioxide Enrichment and Soil Water on Maize,
W87-03002 2I

Irrigation Interval as a Factor in Sweet Corn Response to Salinity,
W87-03003 3C

Climatic Change, Weather Variability, and Corn Production,
W87-03006 2I

Response of Corn to Tillage and Delayed Irrigation,
W87-03007 2I

Nonpoint Source Loading of Phenolic Acids from Decomposing Crop Residue,
W87-03161 5B

Mechanized Tillage Systems Effects on Properties of a Tropical Alfisol in Watersheds Cropped to Maize,
W87-03162 2G

Effect of Deep Tillage and Controlled Traffic on Root Growth, Water-Use Efficiency and Yield of Irrigated Maize and Wheat,
W87-03165 3F

Effects of In-Row and Interrow Subsoiling and Time of Nitrogen Application on Growth, Stomatal Conductance and Yield of Strip-Tilled Corn,
W87-03170 3F

CORRELATION
Structuring of Ecological Data Sets by Methods of Correlation and Cluster Analysis,
W87-02597 2L

CORROSION
Effects of Water Quality Parameters on the Corrosion of Galvanized Steel,
W87-02608 5G

CORROSION CONTROL
Effects of Corrosion Control of Low Alkalinity Waters - Norwegian Experiences,
W87-03045 5F

COSMIC DUST
Placers of Cosmic Dust in the Blue Ice Lakes of Greenland,
W87-02913 2C

COST ALLOCATION
Fertilizers Suitable for the Environment as Part of a Reorientation in Agricultural Policy,
W87-03040 5G

COST ANALYSIS
Effect of Influent Phosphorus Reductions on Great Lakes Sewage Treatment Costs,
W87-02630 5D

Estimation of Wastewater Treatment Costs: Evaluation of the CAPDET Model for Canadian Conditions,
W87-02670 5D

Large Pelton Turbines for Canada's Cat Arm Scheme,
W87-02688 8C

Travel Cost Model for Lake Recreation: A Comparison of Two Methods for Incorporating Site Quality and Substitution Effects,
W87-02872 6D

Cost Analysis of the Adverse Effects of Algal Growth in Water Bodies on Drinking Water Supply,
W87-02977 5F

Under EPA Scrutiny: Underground Storage Tanks,
W87-03021 5B

Minimizing the Cost of Coping with Droughts: Springfield, Illinois,
W87-03057 6D

Financial Planning Model and Its Application,
W87-03058 6B

Complexity in Columbia River Systems Modeling,
W87-03059 6B

Reverse Osmosis Can Be Cost Effective,
W87-03079 3A

Time and Tide Are Right for the Severn Barrage,
W87-03091 8A

Pump Station's Cost Reduced Dramatically,
W87-03121 5D

COST-BENEFIT ANALYSIS
Risk Information for Floodplain Management,
W87-03061 6F

COST BENEFITS
Self-closing Cylindrical Gate Improves Safety at Low Cost,
W87-02693 8C

COSTS
Problems Encountered in The Operation of Small Power Plants, (Problemes Rencontres a la Mise en Service de Microcentrales),
W87-02572 8C

COTTON
Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: II. K(+) Strongly Promotes Development of Membrane Potential in Vesicles from Cotton Roots,
W87-02718 2I

Ammonium (15N) Metabolism in Cotton Under Salt Stress,
W87-03151 5C

Accumulation and Turnover of Abscisic Acid in Osmotically Stressed Cotton Leaf Tissue in Relation to Temperature,
W87-03216 2I

COTTONWEED TREES
Plains Cottonwood Recruitment and Survival on a Prairie Meandering River Floodplain, Milk River, Southern Alberta and Northern Montana,
W87-02769 2I

COWPEA
Rate of Water Loss from Detached Leaves of Drought Resistant and Susceptible Genotypes of Cowpea,
W87-02960 2I

COWPEAS
Effect of Tillage and Mulching on Soil Environment and Cowpea Seedling Growth Under Arid Conditions,
W87-03166 3F

CRATER LAKE
Crater Lake, Oregon: A Restricted Basin with Base-of-Slope Aprons of Nonchannelized Turbidites,
W87-03220 2J

CRAYFISH
Liquid Chromatographic Determination of Fluridone Aquatic Herbicide and Its Metabolite in Fish and Crayfish,
W87-03113 5A

CREEPING BENTGRASS
Contrasting Response to Salt Stress of Two Salinity Tolerant Creeping Bentgrass Clones,
W87-03156 5C

CROP PLANTS
Techniques for Water-Use Measurements of Crop Plants,
W87-02949 7B

CROP RESIDUE
Response of Conservation Tillage Sorghum to Growing Season Precipitation,
W87-03167 3F

CROP WATER
Production Function for Cotton with Dated Irrigation Quantities and Qualities,
W87-03189 3F

CROP YIELD
Effect of Irrigation and Nitrogen Fertilizer on the Yield and Protein Content of Soft White Spring Wheat,
W87-02877 3F

Corn Yield Response to Irrigation, Plant Population and Nitrogen in a Cool, Humid Climate,
W87-02878 3F

Profile Modification and Irrigation Effects on Yield and Water Use of Wheat,
W87-02920 3F

Stochastic Approach to the Crop Yield-Irrigation Relationships in Heterogeneous Soils: I. Analysis of the Field Spatial Variability,
W87-02921 3F

Stochastic Approach to the Crop Yield-Irrigation Relationships in Heterogeneous Soils: II. Application to Irrigation Management,
W87-02922 3F

Integration of Water Stress in Fruit Trees,
W87-02952 2I

Corn Irrigation Scheduling in Humid Regions on Sandy Soils with Tillage Pans,
W87-02981 3F

Growth and Yield of Sunflower and Soybean Under Soil Water Deficits,
W87-02992 2I

Kleingrass Yield and Quality Under Three Irrigation Regimes When Harvested at Anthesis,
W87-02993 3F

Estimation of Spring Wheat Spike Water Concentration and Grain Maturity from Air Temperature,
W87-02998 2I

Comparison of Sprinkler and Flood Irrigation for Rice,
W87-03004 3F

Climatic Change, Weather Variability, and Corn Production,
W87-03006 2I

Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-03009 2I

Muskmelon Growth, Yield, and Nutrition as Influenced by Planting Method and Trickle Irrigation,
W87-03108 3F

Nitrogen Source and Application Timing for Trickle Irrigated Strawberries,
W87-03109 3F

Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. I. Soil Moisture, Water Relations, Tree and Fruit Growth,
W87-03110 3F

Seasonal Growth and Composition and Accumulation of N-P-K in Dryland and Irrigated Pumpkins,
W87-03150 2I

Compaction and Tillage Depth Combinations for Water Management and Rice Production in Low-Retentive Permeable Soils,
W87-03163 3F

Effect of Deep Tillage and Controlled Traffic on Root Growth, Water-Use Efficiency and Yield of Irrigated Maize and Wheat,
W87-03165 3F

Effect of Tillage and Mulching on Soil Environment and Cowpea Seedling Growth Under Arid Conditions,
W87-03166 3F

Effects of In-Row and Interrow Subsoiling and Time of Nitrogen Application on Growth, Stomatal Conductance and Yield of Strip-Tilled Corn,
W87-03170 3F

CROP YIELDS
Response of Conservation Tillage Sorghum to Growing Season Precipitation,
W87-03167 3F

CULTIVATION
Effect of Cultivated and Wild Rice Varieties on the Nitrogen Balance of Flooded Soil,
W87-02813 2I

Changes in Spring Wheat Tillering Patterns in Response to Delayed Irrigation,
W87-03012 2I

Controlling Turfgrass Water Use Rates,
W87-03017 2I

CULTIVATION CONDITIONS
Microbial Polymers in the Aquatic Environment-I: Production by Activated Sludge Microorganisms under Different Conditions,
W87-02694 5D

CULTURE MEDIA
Concentration of Viruses from Water Using Pig Erythrocyte Ghost Cells,
W87-02650 5A

Detection of Enteroviruses: An Assessment of Ten Cell Lines,
W87-02651 5A

Membrane Filtration Enumeration of Faecal Clostridia and Clostridium Perfringens in Water,
W87-02701 5A

Growth of Salmonellas in Different Enrichment Media,
W87-02786 5A

CULTURING TECHNIQUES
Viable but Nonculturable Stage of Campylobacter jejuni and Its Role in Survival in the Natural Aquatic Environment,
W87-02899 5B

CUT-OFF WALLS
Performance of China's First Concrete Cut-off Wall,
W87-02689 8A

CUTTERHEAD DREDGE
Flow Processes of a Cutterhead Dredge,
W87-03262 8C

CYANIDE
Effects of Cyanide on the Methanogenic Degradation of Phenolic Compounds,
W87-02709 5D

CYANOBACTERIA
Underwater Light Climate and the Growth and Pigmentation of Planktonic Blue-green Algae (Cyanobacteria) II. the Influence of Light Quality,
W87-02909 2H

CYANOPHYTA
Underwater Light Climate and the Growth and Pigmentation of Planktonic Blue-Green Algae (Cyanobacteria) I. The Influence of light quantity,
W87-02908 2H

Underwater Light Climate and the Growth and Pigmentation of Planktonic Blue-green Algae (Cyanobacteria) II. the Influence of Light Quality,
W87-02909 2H

Chromatic Regulation of Photosystem Composition in the Photosynthetic System of Red and Blue-Green Algae,
W87-03212 2H

CYLINDRICAL GATES
Self-closing Cylindrical Gate Improves Safety at Low Cost,
W87-02693 8C

DAM CONSTRUCTION
RCC: A Dam Rehab Solution Unearthed,
W87-02770 8F

Construction of Dams on Soils Containing Soluble Salts,
W87-03186 8E

DAM DESIGN
Hydraulic Design of the Selective Withdrawal Structures of the Lost Creek Dam,
W87-03223 8A

Hydraulic Design of the Selective Withdrawal Structures at the Elk Creek Dam,
W87-03225 8A

Determination of Selective Withdrawal System Capacity for Intake Tower Design,
W87-03234 5G

DAM DISCHARGE
Hydraulic Design of the Selective Withdrawal Structures of the Applegate Dam,
W87-03224 8A

DAM SAFETY
Borehole Television for Geotechnical Investigations,
W87-03032 7B

DAMS
Energy Recovery Small Hydro Plants on the Rhone River. The First Months of Operation of Champagneux Power Plant and the Sault-Brenaz Project, (Les Petites Centrales de Recuperation sur le Rhone. Les Premiers Mois d' Exploitation de la Centrale de Champagneux et le Project de Sault-Brenaz),
W87-02575 8C

Characteristics of the Static Performance of Dams Reservoired Hydroelectric Stations,
W87-02866 8A

Lock and Dam 1, Red River Waterway: Hydraulic Model Investigation,
W87-03333 8B

DANGARA
Use of Grouting When Driving Through the Rock Burst Zone in the Dangara Irrigation Tunnel,
W87-03181 8E

DAPHNIA
Effect of Metal Chelation on the Toxicity of Some Environmentally Hazardous Trace Metals to Daphnia magna,
W87-03024 5G

DARGALL LANE
Preliminary Model of Long-Term Changes in Stream Acidity in Southwestern Scotland,
W87-02682 5G

DATA ACQUISITION
Evaporation Data from a Capillary Evaporimeter,
W87-03073 7B

Different Techniques for the Computation of River Nutrient Loads (Methodologies de Quantification des Flux de Nutriments en Riviere),
W87-03298 2H

Research Design for Tucson Aqueduct, Phase B Data Recovery,
W87-03328 6G

DATA ANALYSIS
Meteorological Data Analysis for Drainage System Design,
W87-02882 2B

DATA COLLECTION
Review and Analysis of Methods for Quantifying Instream Flow Requirements,
W87-02933 6D

DATA COLLECTIONS
Few Data about Independent Producers of Hydroelectricity in France, (Quelques Donnees sur la Production Hydroelectrique Autonome en France),
W87-02567 8C

DATA INTERPRETATION
Statistical Technique for Analysis of Environmental Data Containing Periodic Variance Components,
W87-02599 7C

Generalization and Applications of Tracer Dispersion Data,
W87-02620 5B

Interpretation of Tracer Data in Variable Flow Systems,
W87-03070 7B

Statistical Methods for Reservoir Water Quality Investigations,
W87-03322 7C

DATA TRANSMISSION
Cordless Geo-Data Link,
W87-03031 7B

DEBRIS FLOW
Groundwater Seepage Vectors and the Potential for Hillslope Failure and Debris Flow Mobilization,
W87-03193 2F

DECIDUOUS TREES
Red Alder Leaf Litter and Streamwater Quality in Western Oregon,
W87-02631 5B

DECISION MAKING
Use of Climate Predictions to Decide a Water Management Problem,
W87-02633 6A

Decision Support System for Local Water Management,
W87-03064 6D

DECOMPOSING ORGANIC MATTER
Dissolved Organic Matter in Anoxic Pore Waters from Mangrove Lake, Bermuda,
W87-03136 5A

DECOMPOSITION
Decomposition Studies in Two Central Ontario Lakes Having Surficial pHs of 4.6 and 6.6,
W87-02897 2H

DEEP PERCOLATION
Percolation of Water Below an Irrigated Field,
W87-02722 5B

DEEP TILLAGE
Effect of Deep Tillage and Controlled Traffic on Root Growth, Water-Use Efficiency and Yield of Irrigated Maize and Wheat,
W87-03165 3F

DEER CREEK LAKE
Selective Experiences: Alias Withdrawal Pains,
W87-03246 6B

DEFENSE MECHANISMS
Absence of Acclimation to Parathion by Rainbow Trout During Sublethal Exposure,
W87-02697 5C

DEHYDROGENASE
Alcohol Dehydrogenase Activity in the Roots of Marsh Plants in Naturally Waterlogged Soils,
W87-02816 2I

DEICERS
Pollutants Associated with Sand and Salt Applied to Roads in Minnesota,
W87-02943 5B

DELAWARE RIVER
Growth and Survival of Giant Ragweed (Ambrosia trifida L.) in a Delaware River Freshwater Tidal Wetland,
W87-03207 2H

DENGUE
Application of Environmental Management Principles in the Program for Eradication of Aedes (Stegomyia) aegypti (Linneus, 1762) in the Republic of Cuba, 1984,
W87-02824 5G

DENITRIFICATION
Nutrient Transformation in Retention/Detention Ponds Receiving Highway Runoff,
W87-02821 5D

DENMARK
Dissolved and Particulate Load in Danish Water Courses,
W87-03293 5B

Nitrate Load/Discharge Relationships and Nitrate Load Trends in Danish Rivers,
W87-03302 5B

DENTAL CARIES
Need for Fluoridation of Desalinated Water Supplies,
W87-03041 5F

DENUDATION
Denudation of the Piceance Creek Basin, Colorado,
W87-03289 2J

DEPOSITION
Deposition of Atmospheric Trace Metals in Northern Sweden as Measured in the Snowpack,
W87-02720 5B

DERIVED WATER
Analysis and Cartographical Approach to the Regional Water Utilization System in the Yodo River Basin,
W87-02978 6D

DESALINATION
Need for Fluoridation of Desalinated Water Supplies,
W87-03041 5F

Reverse Osmosis Can Be Cost Effective,
W87-03079 3A

DESIGN CITERIA
Designing for Flow,
W87-03125 8A

DESIGN CRITERIA
Environmental Designs for Streambank Protection Projects,
W87-02621 6G

Containing Landfill Leaks,
W87-02639 5B

Computerized Layout Generation for Sanitary Sewers,
W87-03062 8A

Functional Design of Activated Sludge Processes with Heavy Metal Inhibition,
W87-03131 5D

DESIGN FLOW
Sizing Submersible Pumps,
W87-02927 8C

DESIGN STANDARDS
Wastewater Engineering Design for Unsewered Areas,
W87-03339 5E

DESIGN STORMS
Meteorological Data Analysis for Drainage System Design,
W87-02882 2B

Structure, Energetics and Propagation of Rotating Convective Storms. Part I: Energy Exchange with the Mean Flow,
W87-03215 2B

DESULFONATION
Orthanilic Acid and Analogues as Carbon Sources for Bacteria: Growth Physiology and Enzymic Desulphonation,
W87-02781 5D

DETENTION PONDS
Nutrient Transformation in Retention/Detention Ponds Receiving Highway Runoff,
W87-02821 5D

DETENTION RESERVOIRS
Role of Detention Basins for Stormwater Quality Control,
W87-03301 5G

DETERGENTS
Distribution of Anionic Surfactants in the Water Column of the Gulf of Fos-sur-Mer, (Distribution des Detergents Anioniques dans la Colonne d'Eau du Golfe de Fos-sur-Mer),
W87-02563 5B

DETRITUS
Decomposition Studies in Two Central Ontario Lakes Having Surficial pHs of 4.6 and 6.6,
W87-02897 2H

DEVELOPING COUNTRIES
Creation of a Cross-Flow Turbines Range, (Creation d'une Gamme de Turbines a Flux Traversant),
W87-02569 8C

Economy and Performance of Small Turbines, (Economie et Performance des Petites Turbines),
W87-02570 8C

Emergence of Environmental Law in the Developing Countries: A Case Study of India,
W87-02616 6E

Water Supply in Developing Countries: Improving on Current Practice,
W87-02784 5G

DEWATERING
Dewatering of Bottom Sediments,
W87-03261 2J

DIAGENESIS
Early Diagenesis of Cadmium and Cobalt in Sediments of the Laurentian Trough,
W87-03138 5B

DIATOMS
Relationships Among Growth Rate, Cellular Manganese Concentrations and Manganese Transport Kinetics in Estuarine and Oceanic Species of the Diatom Thalassiosira,
W87-02805 2L

Effects of Temperature, Salinity, Irradiance and Diurnal Periodicity on Growth and Photosynthesis in the Diatom Nitzschia americana: Light-Saturated Growth,
W87-02807 2L

DIEL VARIATION
Diel Variation of In-stream Nitrification,
W87-02711 5B

DIETS
Need for Fluoridation of Desalinated Water Supplies,
W87-03041 5F

DIFFERENTIAL EQUATIONS
Immiscible Contaminant Transport in Soils and Groundwater with an Emphasis on Petroleum Hydrocarbons: System of Differential Equations vs Single Cell Model,
W87-02729 5B

DIFFUSION
137C-135C Variations in a Diffusion-Controlled Groundwater System,
W87-03149 5A

DIFFUSION COEFFICIENT
Modified Diffusion Equation for Flood Propagation in Trapezoidal Channels,
W87-02855 2E

DIFFUSIVITY
Algorithm for Computing the Relationship between Diffusivity and Soil Moisture Content from the Hot Air Method,
W87-02856 2G

DIGESTER TANKS
Professional Tank Cleaning Can Make a Difference,
W87-03080 5D

DIGITAL AUTOMATED IRRIGATION SYRINGE
Nursery Irrigation-Syringe System That Monitors Environmental Parameters,
W87-03107 7C

DIKES
Environmental Effects of Dikes and Revetments on Large Riverine Systems,
W87-03321 6G

DIMENSIONAL ANALYSIS
Dimensionless Analysis of Optimum Designs,
W87-03185 8A

DIRECT SEEDING
Muskmelon Growth, Yield, and Nutrition as Influenced by Planting Method and Trickle Irrigation,
W87-03108 3F

DISINFECTION
Managing an Unfiltered Water Supply,
W87-02609 5F

Chlorination to Prevent and Control Waterborne Diseases,
W87-02613 5F

Virus Removal by Activated Sludge Treatment,
W87-02658 5D

Electrofocusing of Viruses and Sensitivity to Disinfection,
W87-02664 5D

Study of Indigenous Virus Removal at Different Stages in a Drinking Water Plant Treating River Water,
W87-02665 5F

Use of Ultraviolet Light in the Treatment of Water in Public Spas and Hot Tubs,
W87-02755 5F

DISK HARROWING
Effect of Tillage and Mulching on Soil Environment and Cowpea Seedling Growth Under Arid Conditions,
W87-03166 3F

DISPERSANTS
Environmental Impact of Oil Spills and the Oil Industry Response,
W87-02829 5C

DISPERSION
Deterministic and Stochastic Analyses of Dispersion in an Unbounded Stratified Porous Medium,
W87-03196 5B

Upstream Weight Multiple-Cell Balance Finite-Element Method for Solving Three-Dimensional Convection-Dispersion Equations,
W87-03197 2F

DISPERSION MODELS
Chemical Control of Soluble Phosphorus in the Amazon Estuary,
W87-03139 5B

DISPERSION STUDIES
Generalization and Applications of Tracer Dispersion Data,
W87-02620 5B

DISSIPATION
Bed Friction and Dissipation in a Combined Current and Wave Motion,
W87-03210 8B

DISSOLVED AIR
Improved Monitoring of Air in Water,
W87-03038 7B

DISSOLVED OXYGEN
Study on the Modelling of the Behavior of Phosphorus Released from Sediments,
W87-02967 2L

Three-dimensional Water-Quality-Transport Model Compared with Field Observations,
W87-02970 2H

Improved Monitoring of Air in Water,
W87-03038 7B

DISSOLVED OXYGEN BUDGETS
Study of Dissolved Oxygen Budgets in Natural and Artificial Lakes,
W87-02976 2H

DISSOLVED SOLIDS
Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships.
W87-03272 5B

Dissolved Loads of Rivers: A Global Overview,
W87-03273 5B

Variation in Solute Concentration Within the River Almond and Its Effect on the Estimated Dissolved Load,
W87-03274 5B

Dissolved Material Concentration in Surface Waters of Africa. Two Contrasting Examples in the Rivers of Togo and the Medjerdah in Tunisia (Evolution de la Concentration en Matieres Dissoutes en Afrique. Deux Exemples Opposes: les Fleuves du Togo et la Medjerdah en Tunisie),
W87-03277 5B

Dissolved Loads in Streams and Rivers - Discharged and Seasonally Related Variations,
W87-03279 5B

Mechanisms of Dissolved Solids Transport in Flysch Drainage Basins,
W87-03281 5B

Runoff Processes and Dissolved Substances During Flood Events in Small Differently Used Drainage Areas,
W87-03283 2E

Atmospheric Inputs and River Transport of Dissolved Substances,
W87-03287 2B

Dissolved and Particulate Load in Danish Water Courses,
W87-03293 5B

Dissolved and Suspended Loads of the Regulated River Nidda in the Rhine-Main Area,
W87-03299 5B

DISTRIBUTION CONSTANT
Prediction of the Distribution Constant of some Solutes Containing Hydrophilic Functional Groups from Data on the Solubility of Water in Organic Solvents,
W87-02906 1B

DISTRIBUTION PATTERNS
Patterns in Distribution and Abundance of a Noncoevolved Assemblage of Estuarine Fishes in California,
W87-02758 2L

Effects of Disturbance on Epiphytic Community Architecture,
W87-02806 2H

Distribution and Standing Crop of Living and Dead Roots in Three Wetland Carex Species,
W87-03204 2H

DISTURBANCE
Effects of Disturbance on Epiphytic Community Architecture,
W87-02806 2H

DOLOMITE
Adsorption of Select Phenol Derivatives by Dolomite,
W87-02583 5B

DOMESTIC WASTES
Membrane Filtration Enumeration of Faecal Clostridia and Clostridium Perfringens in Water,
W87-02701 5A

Phosphorus Removal at Low Sludge Loadings,
W87-02747 5D

Indiana Waste Days Beyond Expectations,
W87-02757 5G

DOMESTIC WATER
Water Use in Urban Korea,
W87-02617 6D

DOSIMETRY
Drinking-Water Contribution to Natural Background Radiation,
W87-03084 5F

DOUBLE-AGAR-LAYER METHOD
Practical Direct Plaque Assay for Coliphages in 100-ml Samples of Drinking Water,
W87-02890 5A

DRAINAGE
Changes in Catchment Runoff Following Drainage and Afforestation,
W87-03072 4C

DRAINAGE BASINS
Modeling North Cascades Annual Runoff Distribution Using Drainage Basin Elevation Distribution,
W87-02627 2E

DRAINAGE EFFECTS
Alternatives to the Use of Agricultural Drainage Wells,
W87-02624 4B

Impacts from Mosquito Control-Induced Sulphur Mobilization in a Cape Cod Estuary,
W87-03127 5C

DRAINAGE SYSTEMS
Meteorological Data Analysis for Drainage System Design,
W87-02882 2B

Restoration of Pipe Drainage in Foundations of Hydraulic Structures on Carbonate Rocks,
W87-03184 8A

DRAINAGE WELLS
Alternatives to the Use of Agricultural Drainage Wells,
W87-02624 4B

DRAINS
Drains as a Boundary Condition in Finite Elements,
W87-03201 2F

DRAWDOWN
Results of Pumping Tests in the Deccan Trap Basalts of Central India,
W87-03076 2F

DREDGING
Evaluation of the Factors Governing the Mobility of Dredged Material Placed at Open Water Disposal Sites,
W87-03252 5E

Numerical Prediction on the Effect of Phosphorus Release Control by Sediment Dredging,
W87-03253 5B

Selection and Management of a New Orlean Dredged Material Disposal Site at Coos Bay, Oregon, USA, to Receive Contaminated Dredged Material,
W87-03263 5E

Principles and Practices for the Ocean Disposal of Dredged Material: The London Dumping Convention Re-Examined,
W87-03267 5E

Mussel Watch Program/Monitoring the Long-Term Effects of Dredged Material Disposal in New England Waters,
W87-03270 5B

DRIFTING SNOW
Snow Loads in the 1985 National Building Code of Canada: Curved Roofs,
W87-02667 2C

DRILL HOLES
Regime of Ground Water of Semberian Aquifer,
W87-03043 2F

DRILLING
Metabolical Activity of Bacteria in Geothermal Spring-waters Dating from Dogger and Trias Periods in the Bassin Parisien, (Activites Metaboliques des Bacteries des Eaux Geothermales du Dogger et du Trias du Bassin Parisien),
W87-02562 5B

DRINKING WATER
Trihalomethane Levels in Chlorinated Michigan Drinking Water,
W87-02605 5F

Lead Dissolution From Soldered Joints,
W87-02607 5B

Detection of Rotavirus in Treated Drinking Water,
W87-02643 5B

Rotavirus Survival in Raw and Treated Waters and Its Health Implications,
W87-02644 5G

Detection of Hepatitis A Virus (HAV) in Drinking Water,
W87-02646 5A

Detection of Hepatitis A Virus in Drinking Water by Enzyme-Immunoassay Using Ultracentrifugation for Virus Concentration,
W87-02647 5A

Concentration of Seeded and Naturally Occurring Enteroviruses from Waters of Varying Quality by Hollow Fiber Ultrafiltration,
W87-02648 5A

Recovery of Viruses from Drinking-Water by Means of an In-Line Electropositive Cartridge Filter,
W87-02649 5A

Analysis of Tap Water for Viruses: Results of a Survey,
W87-02652 5A

Detection and Health Risk Associated with Low Virus Concentration in Drinking Water,
W87-02653 5A

Failure to Detect Cytopathic Enteroviruses in Drinking Water,
W87-02654 5A

Viruses and Bacteria in a Chalk Well,
W87-02655 5B

Study of Indigenous Virus Removal at Different Stages in a Drinking Water Plant Treating River Water,
W87-02665 5F

Indiana Waste Days Beyond Expectations,
W87-02757 5G

Concentrations of 20 Volatile Organic Compounds in the Air and Drinking Water of 350 Residents of New Jersey Compared with Concentrations in Their Exhaled Breath,
W87-02774 5B

Prevention and Treatment of Endemic Iodine-Deficiency Goiter by Iodination of a Municipal Water Supply,
W87-02779 5F

Flow Injection Analysis of Chloride in Tap and Sewage Water Using Ion-Selective Electrode Detection,
W87-02798 5A

Public Policy Implications of Toxic Chemicals in Drinking Water: A Case Study of Long Island, NY,
W87-02826 5C

Physiological Innocuity of Asbestos in Water,
W87-02831 5C

Toxic Substances, Risk Management and New York State Drinking Water,
W87-02832 5B

Health Effects of Arsenic in the Aqueous Environment,
W87-02833 5C

Practical Direct Plaque Assay for Coliphages in 100-ml Samples of Drinking Water,
W87-02890 5A

Bacteria Associated with Granular Activated Carbon Particles in Drinking Water,
W87-02891 5B

Use of Geostatistics to Predict Virus Decay Rates for Determination of Septic Tank Setback Distances,
W87-02895 5B

Cost Analysis of the Adverse Effects of Algal Growth in Water Bodies on Drinking Water Supply,
W87-02977 5F

Drinking-Water Contribution to Natural Background Radiation,
W87-03084 5F

Drinking Water Materials: Field Observations and Methods of Investigation,
W87-03340 5F

DRINKING WATER REGULATIONS
Safe Drinking Water Act,
W87-03122 6E

DRIP EMITTERS
Inexpensive System Using Drip-Emitters for Irrigating Small Plots,
W87-02876 3F

DRIP IRRIGATION
Inexpensive System Using Drip-Emitters for Irrigating Small Plots,
W87-02876 3F

Drip and Minis, in the Commercial Landscape,
W87-02948 3F

DROUGHT
Dealing with the Drought,
W87-02565 3F

Use of Climate Predictions to Decide a Water Management Problem,
W87-02633 6A

Evolution in Space and Time of an Alluvial Aquifer under the Effect of an Exceptional Multi-Year Drought (Mediterranean Shore, Herault, France) (Evolution Spatio-Temporelle d'un Aquifere Alluvial sous l'Effet d'une Secheresse Pluriannuelle Exceptionnelle (Littoral Mediterraneen, Herault, France)),
W87-02838 2F

Gas Exchange of Field-Grown Soybean Under Drought,
W87-02999 2I

Minimizing the Cost of Coping with Droughts: Springfield, Illinois,
W87-03057 6D

Drought and Power Production,
W87-03060 6D

DROUGHT POLICY
Drought Policy in the U.S. and Australia: A Comparative Analysis,
W87-02937 6E

DROUGHT RESISTANCE
Rate of Water Loss from Detached Leaves of Drought Resistant and Susceptible Genotypes of Cowpea,
W87-02960 2I

Root Systems in Relation to Stress Tolerance,
W87-02961 2I

Procedure to Select Drought-Tolerant Sorghum and Millet Genotypes Using Canopy Temperature and Vapor Pressure Deficit,
W87-03001 2I

Drought Avoidance in Tall Fescue,
W87-03019 2I

Triadimefon Protects Bean Plants from Water Stress through its Effects on Abscisic Acid,
W87-03202 2I

DRY FARMING
Dryland Grain Sorghum Water Use, Light Interception, and Growth Response to Planting Geometry,
W87-03008 2I

DRY MATTER YIELD
Microclimate of an Upland Grassland,
W87-03101 2I

DRY ROOT ROT
Effect of Tillage and Mulching on Soil Environment and Cowpea Seedling Growth Under Arid Conditions,
W87-03166 3F

DRY SEASON
Modeling for Estimating Representative Water Conditions in a River Basin,
W87-02604 5B

DRYLAND CULTURE
Seasonal Growth and Composition and Accumulation of N-P-K in Dryland and Irrigated Pumpkins,
W87-03150 2I

DUAL-USE FILTERS
Dual-use Filters Keep Wet-weather Flows Under Control,
W87-02926 5D

DUCKWEED
Toxicity Tests of Aquatic Pollutants by Using Common Duckweed,
W87-02582 5A

Boron Tolerance and Accumulation in the Duckweed, Lemna minor,
W87-03152 5C

Micronutrient Tolerance and Accumulation in the Duckweed, Lemna,
W87-03153 5C

DUTCH KILLS CHANNEL
Effectiveness of Capping in Isolating Dutch Kills Sediment from Biota and the Overlying Water,
W87-03332 5G

DYNAMIC EQUILIBRIUM
Designing for Dynamic Equilibrium in Streams,
W87-02929 2E

EARTH TIDES
Analysis of Earth-Tide-Induced Groundwater Flow in Eastern Botswana,
W87-02840 2F

EARTHFILL DAMS
Geological Problems Overcome at Revelstoke: Part Two,
W87-02692 8D

EARTHWORKS
Effective Technology of Constructing Earth Structures,
W87-02864 8A

Cordless Geo-Data Link,
W87-03031 7B

EAST LYNN LAKE
Selective Experiences: Alias Withdrawal Pains,
W87-03246 6B

EAST SHROPSHIRE
Compaction, Hydrological Processes and Soil Erosion on Loamy Sands in East Shropshire, England,
W87-03160 2J

ECOLOGICAL DATA
Structuring of Ecological Data Sets by Methods of Correlation and Cluster Analysis,
W87-02597 2L

ECOLOGICAL EFFECTS
Effects of Disturbance on Epiphytic Community Architecture,
W87-02806 2H

Ecological Evaluation of Organotin-Contaminated Sediment,
W87-03254 5B

ECOLOGICAL MODEL
Three-dimensional Water-Quality-Transport Model Compared with Field Observations,
W87-02970 2H

ECOLOGICAL MODELS
Modelling of the Lower Trophic Levels of a Marine Ecosystem and Its Example of Short-period Variations of Chlorophyll and Nutrient in Harima-Nada,
W87-02601 2L

Ecological Modelling, Monitoring and Implementation in Irrigated Agriculture,
W87-02966 3F

Basin-wide Ecological Fate Model for Management of Chemicals Hazard,
W87-02975 5B

Modelling of Industrial Ecological Systems for Evaluation of Health Services,
W87-02979 4C

ECOLOGY
Patterns in Distribution and Abundance of a Noncoevolved Assemblage of Estuarine Fishes in California,
W87-02758 2L

Ecology and Estuarine Impact Assessment: Lessons Learned from the Hudson River (U.S.A.) and Other Estuarine Experiences,
W87-02776 2L

Effects of Disturbance on Epiphytic Community Architecture,
W87-02806 2H

Effects of Variation in Streamside Habitats on the Composition of Mountain Salamander Communities,
W87-03082 2H

ECONOMIC ASPECTS
Emerging Trends in Infrastructure Financing,
W87-02606 6C

Finding Uses for Sludge,
W87-02641 5E

ECONOMIC EVALUATION
Existence Values and Normative Economics: Implications for Valuing Water Resources,
W87-03188 6B

ECONOMIC FEASIBILITY
Taking Hydrology and Economic Factors into Account for Calculating the Economic Diameter of the Penstocks for High Head Micropower Plants, (Prise en Compte de l'Hydrologie et des Facteurs Economiques dans le Calcul du Diametre Economique des Conduites Forcees des Microcentrales Haute Chute),
W87-02568 8C

ECONOMIC RENT
Distribution of Economic Rents Arising from Subsidized Water When Land is Leased,
W87-02874 6C

ECOSYSTEMS
Classification of Macrophytes in Bodies of Water and of Aquatic Vegetation,
W87-02772 2H

Effects of Disturbance on Epiphytic Community Architecture,
W87-02806 2H

Effects of Current Velocity and Light Energy on the Structure of Periphyton Assemblages in Laboratory Streams,
W87-02808 2H

Synthesis and Analysis of a Comprehensive Lake Model - With the Evaluation of Diversity of Ecosystems,
W87-02965 2H

Vegetation of the Low-Shrub Bogs of Northern New Jersey and Adjacent New York: Ecosystems at their Southern Limit,
W87-03208 2H

EDERSEE RESERVOIR
Comparison of Water Quality in Drainage Basins Under Agricultural and Forest Land Use,
W87-03307 2E

EDUCATION
Application of Environmental Management Principles in the Program for Eradication of Aedes (Stegomyia) aegypti (Linneus, 1762) in the Republic of Cuba, 1984,
W87-02824 5G

EFFLUENTS
Detection of Indigenous Enteric Viruses in Raw Sewage Effluents of the City of Athens, Greece, during a Two Year Survey,
W87-02659 5B

Membrane Filtration Enumeration of Faecal Clostridia and Clostridium Perfringens in Water,
W87-02701 5A

Improved Method for Recovery of Enteric Viruses from Wastewater Sludges,
W87-02710 5A

$5.00, 1-Minute Effluent Quality Tester,
W87-02814 7B

Salmonellae and Pollution Indicator Bacteria in Municipal and Food Processing Effluents and the Cornwallis River,
W87-02815 5D

Effect of Soil and Effluent Characteristics on Phosphorus Sorption in Dosed Columns,
W87-02861 2G

Dual-use Filters Keep Wet-weather Flows Under Control,
W87-02926 5D

Trickle Irrigation of Wheat Applying Renovated Wastewater,
W87-02938 3F

Interactive Effects of Sewage Effluent Irrigation and Supplemental Fertilization on Container-Grown Trees,
W87-02958 3C

Effect of Effluent Recirculation on the Performance of a Two Stage Anaerobic Process,
W87-03088 5D

Evaluation of Effluent from Grass Silage as a Feed for Beef Cattle Offered Silage-based Diets,
W87-03099 5E

EFFORD LAKE
Effects of Sulphide on Survival of Aero-Aquatic and Aquatic Hyphomycetes,
W87-03174 5C

EGGS
Levels of Chlorinated Hydrocarbons and Composition of PCB in Herring Gull Larus argentatus Eggs Collected in Norway in 1969 Compared to 1979-81,
W87-02585 5B

EGYPT
General Impact of Aswan High Dam,
W87-03066 6G

ELBE RIVER ESTUARY
Direct Determination of Cd, Cu and Ni in the Elbe River Estuary with Zeeman AAS and Matrix Modification (Direktbestimmung von Cd, Cu and Ni im Elbeastuar mit Hilfe der Zeeman-Atomabsorptionsspektroskopie und Matrixmodifikation),
W87-03087 5A

ELECTRIC POWER COSTS
Economy and Performance of Small Turbines, (Economie et Performance des Petites Turbines),
W87-02570 8C

ELECTRIC POWER PRODUCTION
Few Data about Independent Producers of Hydroelectricity in France, (Quelques Donnees sur la Production Hydroelectrique Autonome en France),
W87-02567 8C

ELECTRICAL EQUIPMENT
Experience of Using the Turbine-Generator Units of the Kolyma Hydroelectric Station for Idle Discharge of Water,
W87-03177 8C

ELECTRICAL STUDIES
Aquifer Transmissivity of Porous Media from Resistivity Data,
W87-02837 7B

ELECTROFOCUSING
Electrofocusing of Viruses and Sensitivity to Disinfection,
W87-02664 5D

ELECTRON PARAMAGNETIC RESONANCE SPECTROSCOPY
Speciation of Manganese in Freshwaters,
W87-03051 2K

ELEVATION
Modeling North Cascades Annual Runoff Distribution Using Drainage Basin Elevation Distribution,
W87-02627 2E

ELK CREEK DAM
Hydraulic Design of the Selective Withdrawal Structures at the Elk Creek Dam,
W87-03225 8A

ELONGATING SECONDARY HYPHAE
Water or Salt Stress Increases Infectivity of Erysiphe pisi Conidia Taken from Stressed Plants,
W87-03175 5C

ELUTION
Improved Method for Recovery of Enteric Viruses from Wastewater Sludges,
W87-02710 5A

EMBANKMENTS
Effective Technology of Constructing Earth Structures,
W87-02864 8A

ENGLAND
Decline of the Gastropod Nucella lapillus Around South-West England: Evidence for the Effect of Tributyltin from Antifouling Paints,
W87-03053 5C

Modelling the Effects of Acidic Deposition And Conifer Afforestation on Stream Acidity in the British Uplands,
W87-03068 5C

Exposure to Fluoridated Public Water Supplies and Child Health and Behaviour,
W87-03092 5C

ENRICHMENT
Effects of Carbon Dioxide Enrichment and Soil Water on Maize,
W87-03002 2I

ENTEROVIRUSES
Genomic Analysis of RNA Viruses Isolated from Water,
W87-02645 5A

Concentration of Seeded and Naturally Occurring Enteroviruses from Waters of Varying Quality by Hollow Fiber Ultrafiltration,
W87-02648 5A

Detection of Enteroviruses: An Assessment of Ten Cell Lines,
W87-02651 5A

Failure to Detect Cytopathic Enteroviruses in Drinking Water,
W87-02654 5A

Detection of Indigenous Enteric Viruses in Raw Sewage Effluents of the City of Athens, Greece, during a Two Year Survey,
W87-02659 5B

Detection and Stability of Enteric Viruses in Sludge, Soil and Ground Water,
W87-02662 5B

Examination of the Penetration of Enteric Viruses in Soils under Simulated Conditions in the Laboratory,
W87-02663 5B

Enterovirus Removal from Sewage: The Effectiveness of Four Different Treatment Plants,
W87-02706 5D

Improved Method for Recovery of Enteric Viruses from Wastewater Sludges,
W87-02710 5A

Practical Direct Plaque Assay for Coliphages in 100-ml Samples of Drinking Water,
W87-02890 5A

Mechanism of Inactivation of Enteric Viruses in Fresh Water,
W87-02893 5B

ENVIRONMENTAL EFFECTS
General Impact of Aswan High Dam,
W87-03066 6G

Effects of Hydraulic Projects and Their Management on Water Quality,
W87-03297 6G

Environmental Effects of Dikes and Revetments on Large Riverine Systems,
W87-03321 6G

Acid Rain: A Review of the Phenomenon in the EEC and Europe.
W87-03338 5C

ENVIRONMENTAL ENGINEERING
Planning and Technology in Sanitary and Environmental Engineering,
W87-03098 6A

ENVIRONMENTAL GRADIENTS
Environmental Gradients in Northwest Freshwater Wetlands,
W87-02615 2H

ENVIRONMENTAL IMPACT STATEMENT
Ecology and Estuarine Impact Assessment: Lessons Learned from the Hudson River (U.S.A.) and Other Estuarine Experiences,
W87-02776 2L

ENVIRONMENTAL LAW
Emergence of Environmental Law in the Developing Countries: A Case Study of India,
W87-02616 6E

ENVIRONMENTAL POLICY
Ecology and Estuarine Impact Assessment: Lessons Learned from the Hudson River (U.S.A.) and Other Estuarine Experiences,
W87-02776 2L

More Awareness Sought Concerning Role of Metals in Pollution,
W87-02791 5B

ENVIRONMENTAL PROTECTION
Small Hydroelectric Plants and Environemental Protection, (Petite Hydraulique et Protection de l'Environment),
W87-02573 8C

Emergence of Environmental Law in the Developing Countries: A Case Study of India,
W87-02616 6E

Environmental Designs for Streambank Protection Projects,
W87-02621 6G

More Awareness Sought Concerning Role of Metals in Pollution,
W87-02791 5B

ENVIRONMENTAL TRACERS
Interpretation of Tracer Data in Variable Flow Systems,
W87-03070 7B

ENZYMES
Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: I. Salinity During Growth Modulates the Proton Pump in the Halophyte Atriplex Nummularia,
W87-02717 2I

Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: II. K(+) Strongly Promotes Development of Membrane Potential in Vesicles from Cotton Roots,
W87-02718 2I

Polyphosphate Kinase Activity during Phosphate Uptake by Bacteria,
W87-02736 5D

Orthanilic Acid and Analogues as Carbon Sources for Bacteria: Growth Physiology and Enzymic Desulphonation,
W87-02781 5D

ENZYMES

Effects of Light on Growth, RuBPCase Activity and Chemical Composition of Ulva Species (Chlorophyta),
W87-02809 2L

Alcohol Dehydrogenase Activity in the Roots of Marsh Plants in Naturally Waterlogged Soils,
W87-02816 2I

EPIDEMICS

Application of Environmental Management Principles in the Program for Eradication of Aedes (Stegomyia) aegypti (Linneus, 1762) in the Republic of Cuba, 1984,
W87-02824 5G

EPIPHYTES

Effects of Disturbance on Epiphytic Community Architecture,
W87-02806 2H

EROSION

Erosion of Unconsolidated Gravel Beds,
W87-02673 2J

ESCHERICHIA COLI

Effect of Organotins on Fecal Pollution Indicator Organisms,
W87-02901 5C

ESTIMATING

Chubb/Bauman Method for Estimating the Recreation Potential of Rivers: A Critical Review,
W87-02634 6A

Aquifer Transmissivity of Porous Media from Resistivity Data,
W87-02837 7B

Water Use Efficiency in Soybean Pubescence Density Isolines-A Calculation Procedure for Estimating Daily Values,
W87-03000 2I

ESTIMATING EQUATIONS

Estimating Generalized Soil-water Characteristics from Texture,
W87-02727 2G

Simple Approximation for a Moving Interface in a Coastal Aquifer,
W87-02851 2F

Modified Diffusion Equation for Flood Propagation in Trapezoidal Channels,
W87-02855 2E

ESTUARIES

Chione (Austrovenus) stutchburyi, a New Zealand Cockle, as a Bio-indicator for Lead Pollution,
W87-02586 5A

Modeling of Pollutant Dispersion in Stratified Oscillatory Flows,
W87-02885 5B

Development of a Method for Concentration of Rotavirus and Its Application to Recovery of Rotaviruses from Estuarine Waters,
W87-02896 5A

Geochemistry of Tin in Rivers and Estuaries,
W87-03140 5B

Nutrient and Sediment Budgets for the Tidal Potomac River and Estuary,
W87-03290 5B

ESTUARINE ENVIRONMENT

Patterns in Distribution and Abundance of a Noncoevolved Assemblage of Estuarine Fishes in California,
W87-02758 2L

Ecology and Estuarine Impact Assessment: Lessons Learned from the Hudson River (U.S.A.) and Other Estuarine Experiences,
W87-02776 2L

Relationships Among Growth Rate, Cellular Manganese Concentrations and Manganese Transport Kinetics in Estuarine and Oceanic Species of the Diatom Thalassiosira,
W87-02805 2L

Impacts from Mosquito Control-Induced Sulphur Mobilization in a Cape Cod Estuary,
W87-03127 5C

ESTUARINE POLLUTION

Slack Tide Oxygen Balance Model,
W87-02889 5B

ESW TECHNIQUE

Materials Technology for Turbine Performance,
W87-02687 8C

EUROPEAN ECONOMIC COMMUNITY

Acid Rain: A Review of the Phenomenon in the EEC and Europe.
W87-03338 5C

EUTROPHIC LAKES

Box Model for Prediction of Water Quality in Eutrophic Lakes,
W87-02972 2H

EUTROPHIC WATERS

Study on the Modelling of the Behavior of Phosphorus Released from Sediments,
W87-02967 2L

EUTROPHICATION

Determination of Pollution and Eutrophic Conditions of Sapanca Lake (Turkey),
W87-02587 5B

Validation of a Prognosis Based Upon a Eutrophication Model,
W87-02602 5C

Problem of Phosphorus in France - Its Presence in Natural Waters and Biological Phosphorus Removal,
W87-02734 5G

Modelling of Stratified Flow and Eutrophication in Reservoirs,
W87-02968 5C

Eutrophication Model of Lake Kasumigaura,
W87-02971 2H

Assessment of the Impact of Eutrophication Control Measures on South African Impoundments,
W87-02973 5G

Review of the Role of Bed Deposits in the Phosphate Eutrophication of Lakes and Rivers,
W87-03022 5B

EVAPORATION

Evaporation from the Understorey in the Jarrah (Eucalyptus Marginata Don Ex Sm.) Forest, Southwestern Australia,
W87-02679 2D

Algorithm for Computing the Relationship between Diffusivity and Soil Moisture Content from the Hot Air Method,
W87-02856 2G

Evaporation Data from a Capillary Evaporimeter,
W87-03073 7B

Evaporation and Redistribution of Salts in a Silt Loam Soil as Affected by Tillage Induced Soil Mulch,
W87-03168 3F

EVAPOTRANSPIRATION

Techniques for Water-Use Measurements of Crop Plants,
W87-02949 7B

Use of Portable Rainout Shelters to Induce Water Stress,
W87-02991 2I

Growth and Yield of Sunflower and Soybean Under Soil Water Deficits,
W87-02992 2I

Yield and Physiological Responses of Potatoes to Deficit, High Frequency Sprinkler Irrigation,
W87-02997 3F

Water Use Efficiency in Soybean Pubescence Density Isolines-A Calculation Procedure for Estimating Daily Values,
W87-03000 2I

Dryland Grain Sorghum Water Use, Light Interception, and Growth Response to Planting Geometry,
W87-03008 2I

Turfgrass Water Use Rates,
W87-03014 2I

EXCAVATION

Instruments and Expertise Add Up to Good Pipe Locating,
W87-02928 8C

EXCESS RAINFALL

Effect of Rainfall Excess Calculations on Modeled Hydrograph Accuracy and Unit-Hydrograph Parameters,
W87-02623 2B

Determination of Rainfall Excess on Spatially Variable Catchments,
W87-02853 2A

EXE RIVER

Stream Solute Behaviour in the River Exe Basin, Devon, UK,
W87-03286 5B

EXPERIMENTAL DESIGN

Rational Allocation of Monitoring Stations in a Lake by Means of the Spline Technique,
W87-02598 7A

EXTRACTION

New Procedure for Extraction of Ammonium from Natural Waters for 15N Isotopic Ratio Determinations,
W87-02902 5A

Determination of Organically-associated Trace Metals in Estuarine Sea-Water by Solvent Extraction and Atomic-Absorption Spectrometry,
W87-03173 5A

EXTREME VALUE THEORY

Extreme Value Theory Based on the r Largest Annual Events,
W87-03069 2L

EXUDATION

Resistance of Plant Roots to Water Loss,
W87-03005 2I

F.E. WALTER DAM

Hydraulic Design: Bloomington Lake and F. E. Walter Dam Project's Selective Withdrawal Structures,
W87-03233 8A

FABRICATION

Experiencein the Manufacture and Installation of the Reinforced Concrete-Encased Steel Pipelines of the Zagorsk Pumped-Storage Station,
W87-02869 8A

FALLOWING
Effect of Standing Small Grain Stubble on Snow Cover Characteristics in Alternate Fallow Strip Cropping,
W87-02990 2C

FARM MANAGEMENT
Effect of Tillage and Mulching on Soil Environment and Cowpea Seedling Growth Under Arid Conditions,
W87-03166 3F

FARM WORKERS
Water and Hygiene: The Case of North Carolina Farmworkers,
W87-02756 6D

FATE OF POLLUTANTS
Diel Variation of In-stream Nitrification,
W87-02711 5B

Immiscible Contaminant Transport in Soils and Groundwater with an Emphasis on Petroleum Hydrocarbons: System of Differential Equations vs Single Cell Model,
W87-02729 5B

Sorption of Hydrophobic Trace Organic Compounds in Groundwater Systems,
W87-02730 5B

Retardation of Toxic Chemicals in a Contaminated Outwash Aquifer,
W87-02731 5B

Biodegradation of Methanol and Tertiary Butyl Alcohol in Subsurface Systems,
W87-02732 5B

Nitrilotriacetic Acid in Sludge-amended Soil: Mobility and Effects on Metal Solubility,
W87-02765 5E

Medical Geology,
W87-02825 5C

Public Policy Implications of Toxic Chemicals in Drinking Water: A Case Study of Long Island, NY,
W87-02826 5C

Managing the Industrial/Hazardous Contributions to the Niagara River,
W87-02828 5G

Vertical Transport and Fate of Low-Water-Solubility Chemicals in Unsaturated Soils,
W87-02836 5B

Model Simulation of Solute Leaching and Its Application for Estimating the Net Rate of Nitrate Formation under Field Conditions,
W87-02839 5B

Continuous Monitoring of 222Rn Concentration in Unconfined Groundwater,
W87-02847 5A

Effect of Soil and Effluent Characteristics on Phosphorus Sorption in Dosed Columns,
W87-02861 2G

Decomposition Studies in Two Central Ontario Lakes Having Surficial pHs of 4.6 and 6.6,
W87-02897 2H

Transport and Loss of Nitrous Oxide in Soil Water After Forest Clear-cutting,
W87-02912 5B

Early Diagenesis of Cadmium and Cobalt in Sediments of the Laurentian Trough,
W87-03138 5B

Geochemistry of Tin in Rivers and Estuaries,
W87-03140 5B

Ecological Evaluation of Organotin-Contaminated Sediment,
W87-03254 5B

Characterization of Sediment Contamination Utilizing Bioassay/Biaccumulation Testing,
W87-03255 5B

Nitrate Load/Discharge Relationships and Nitrate Load Trends in Danish Rivers,
W87-03302 5B

FATE OF POLLUTANTS *FISH
Liquid Chromatographic Determination of Fluridone Aquatic Herbicide and Its Metabolite in Fish and Crayfish,
W87-03113 5A

FATIGUE CRACKING
Materials Technology for Turbine Performance,
W87-02687 8C

FECES
Effect of Organotins on Fecal Pollution Indicator Organisms,
W87-02901 5C

FEDJ-EL-ADOUM DEPOSIT
Organic Water: Isotopic Characterization and Evidence for Its Role in the Fedj-el-Adoum Pb-Zn Deposit, Tunisia (Eau organique: caracterisation isotopique et evidence de son role dans le gisement Pb-Zn de Fedj-el-Adoum, Tunisie),
W87-03090 5B

FEED
Evaluation of Effluent from Grass Silage as a Feed for Beef Cattle Offered Silage-based Diets,
W87-03099 5E

FEEDLOT WASTES
Evaluation of Effluent from Grass Silage as a Feed for Beef Cattle Offered Silage-based Diets,
W87-03099 5E

FEEDS
Mixed-Culture Microbial Protein from Waste Sulfite Pulping Liquor II: Its Production on a Pilot-Plant Scale and Use in Animal Feed,
W87-03132 5E

FEMA MODELS
Field Validation of the Contaminant Transport Model, FEMA,
W87-03089 5B

FENS
Atmospheric Methane Sources: Alaskan Tundra Bogs, an Alpine Fen, and a Subarctic Boreal Marsh,
W87-02719 5B

FERMENTATION
Effects of Chloroform Toxicity on Methane Fermentation,
W87-02704 5D

Biogenic Methane Formation in Marine and Freshwater Environments: CO2 Reduction vs. Acetate Fermentation-Isotope Evidence,
W87-03137 5B

FERTILIZATION
Snow and Fertilizer Management for Continuous Zero-Till Spring Wheat,
W87-02879 3F

Interactive Effects of Sewage Effluent Irrigation and Supplemental Fertilization on Container-Grown Trees,
W87-02958 3C

FERTILIZER
Manurial Value of Septic-Tank Sludge on Grassland,
W87-03102 5E

Nitrogen Source and Application Timing for Trickle Irrigated Strawberries,
W87-03109 3F

FERTILIZERS
Effect of Irrigation and Nitrogen Fertilizer on the Yield and Protein Content of Soft White Spring Wheat,
W87-02877 3F

Fertilizers Suitable for the Environment as Part of a Reorientation in Agricultural Policy,
W87-03040 5G

Effect of Subsoiling and Irrigation on Potato Production,
W87-03169 3F

FIBER OPTICS
Soil-Water Determination Using Fiber Optics,
W87-02723 2G

FIELD TESTS
Macrophyte Growth in Shallow Streams: Field Investigations,
W87-02887 5C

Air Encapsulation: I. Measurement in a Field Soil,
W87-02915 2G

Three-dimensional Water-Quality-Transport Model Compared with Field Observations,
W87-02970 2H

Field Validation of the Contaminant Transport Model, FEMA,
W87-03089 5B

Field Measurements at Intake Structures,
W87-03240 8B

FILTRATION
Managing an Unfiltered Water Supply,
W87-02609 5F

Slow Sand Filtration: Influences of Selected Process Variables,
W87-02611 5F

Recovery of Viruses from Drinking-Water by Means of an In-Line Electropositive Cartridge Filter,
W87-02649 5A

Innovative Technique for Determining Velocity Gradient in Coagulation--Flocculation Process,
W87-02708 5F

Comparison of Clark's Presence-Absence Test and the Membrane Filter Method for Coliform Detection in Potable Water Samples,
W87-02892 5A

Humic Acid Interference with Virus Recovery by Electropositive Microporous Filters,
W87-02900 5A

Water Supply of Varanasi - The Oldest City of India,
W87-03039 5F

FINANCIAL PLANNING *WATER COSTS
Financial Planning Model and Its Application,
W87-03058 6B

FINANCING
Financial Viability and Economic Efficiency of Water Supply in Kwara State - The Case of Ilorin,
W87-03046 5F

FINITE ELEMENT METHOD
Finite-Element Collocation Method for Variably Saturated Flow in Two Space Dimensions,
W87-03192 2F

FINITE ELEMENT METHOD

Upstream Weight Multiple-Cell Balance Finite-Element Method for Solving Three-Dimensional Convection-Dispersion Equations,
W87-03197 2F

FINITE ELEMENT METHODS
Drains as a Boundary Condition in Finite Elements,
W87-03201 2F

FINLAND
Environmental Factors Affecting the Acid Neutralization Capacity of Finnish Glacial Till Deposits,
W87-02588 5B

FIRE MANAGEMENT
Watershed Modeling for Fire Management Planning in the Northern Rocky Mountains,
W87-03323 4D

FISH
Patterns in Distribution and Abundance of a Noncoevolved Assemblage of Estuarine Fishes in California,
W87-02758 2L

Possibilities of Improving the Determination of Extremely Low Lead Concentrations in Marine Fish by Graphite Furnace Atomic Absorption Spectrometry,
W87-02794 5A

Synthesis and Analysis of a Comprehensive Lake Model - With the Evaluation of Diversity of Ecosystems,
W87-02965 2H

Eutrophication Model of Lake Kasumigaura,
W87-02971 2H

FISH BARRIERS
Passive Screen Water Intake Design Studies,
W87-02767 8I

FISH HABITATS
Tenmile Creek: A study of Stream Relocation,
W87-02935 4A

FISHERIES
Stream Improvements and Fish Response: A Bio-engineering Assessment,
W87-02932 4A

FISHTRAP LAKE
Selective Experiences: Alias Withdrawal Pains,
W87-03246 6B

FIXED FILM REACTORS
Effect of Effluent Recirculation on the Performance of a Two Stage Anaerobic Process,
W87-03088 5D

FJORDS
Vertical Diffusion in Meromictic Powell Lake, British Columbia,
W87-02780 2H

FLAGELLATES
Interaction Between Motile Phytoplankton and Langmuir Circulation,
W87-02969 2L

FLAME ABSORPTION SPECTROSCOPY
Flame Absorption Spectroscopic Determination of Cadmium, Copper, Iron, Lead, and Zinc in Mussels,
W87-03115 5A

FLOCCULATION
Bacteria and Viruses in Aerobically Digested Sludge: Influence of Physical and Chemical Treatments on Survival and Association with Flocs under Laboratory Conditions,
W87-02660 5D

Seawater Induced Algal Flocculation,
W87-02703 5D

Innovative Technique for Determining Velocity Gradient in Coagulation--Flocculation Process,
W87-02708 5F

Improved Method for Recovery of Enteric Viruses from Wastewater Sludges,
W87-02710 5A

Water Supply of Varanasi - The Oldest City of India,
W87-03039 5F

FLOOD CONTROL
Management of Instream Flows through Runoff Detention and Retention,
W87-02934 4A

FLOOD DAMAGE
Risk Information for Floodplain Management,
W87-03061 6F

FLOOD FORECASTING
Effect of Rainfall Excess Calculations on Modeled Hydrograph Accuracy and Unit-Hydrograph Parameters,
W87-02623 2B

Comparison of MOBED and HEC-6 River Flow Models,
W87-02669 2E

FLOOD FREQUENCY
Classification of Drainage Basins According to their Physical Characteristics; An Application for Flood Frequency Analysis in Scotland,
W87-02683 2E

Unbiased Plotting Positions for the General Extreme Value Distribution,
W87-03071 2E

Hydrologic Similarity: 1. Derivation of the Dimensionless Flood Frequency Curve,
W87-03194 2E

Value of Historical Data in Flood Frequency Analysis,
W87-03200 2E

FLOOD INSURANCE
Coastal Flood Insurance,
W87-02782 6F

FLOOD IRRIGATION
Comparison of Sprinkler and Flood Irrigation for Rice,
W87-03004 3F

Transport of Conservative Tracers in the Field Under Intermittent Flood Irrigation,
W87-03191 2G

FLOOD PLAIN MANAGEMENT
Plains Cottonwood Recruitment and Survival on a Prairie Meandering River Floodplain, Milk River, Southern Alberta and Northern Montana,
W87-02769 2I

Risk Information for Floodplain Management,
W87-03061 6F

FLOOD PLAINS
Plains Cottonwood Recruitment and Survival on a Prairie Meandering River Floodplain, Milk River, Southern Alberta and Northern Montana,
W87-02769 2I

FLOOD ROUTING
Modified Diffusion Equation for Flood Propagation in Trapezoidal Channels,
W87-02855 2E

Analytical and Numerical Solution of Saint-Venant Equations,
W87-03067 2E

FLOODPLAIN MANAGEMENT
Floodplain Management Handbook.
W87-03330 6F

FLOODS
Coastal Flood Insurance,
W87-02782 6F

Nutrient and Trace Metal Fluxes in the Magela Creek System, Northern Australia,
W87-02974 2E

Runoff Processes and Dissolved Substances During Flood Events in Small Differently Used Drainage Areas,
W87-03283 2E

Influence of Catastrophic Floods on Water Quality as Recorded in the Sediments of Blagdon Lake, England,
W87-03306 2H

FLORA
Evaporation from the Understorey in the Jarrah (Eucalyptus Marginata Don Ex Sm.) Forest, Southwestern Australia,
W87-02679 2D

FLORIDA
Antidegradation Policy for Preserving Surface Water Quality in Florida,
W87-02636 5G

FLOTATION
Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-02751 5D

FLOUNDERS
Seasonal Abundance, Growth, Feeding and Age Composition of Flounder (Platichthys flesus (L.)) Populations of the Severn Estuary and Bristol Channel,
W87-03027 2L

FLOW
Real-Time Kinematic Catchment Model for Hydro Operation,
W87-02766 2E

FLOW AROUND OBJECTS
Evolution of a Single Wake Behind a Pair of Bluff Bodies,
W87-02862 2E

FLOW CHARACTERISITICS
Designing for Flow,
W87-03125 8A

FLOW CHARACTERISTICS
Comparison of MOBED and HEC-6 River Flow Models,
W87-02669 2E

Kinematic Overland Flow: Generalization of Rose's Approximate Solution,
W87-02841 2E

Analysis of Stochastic Groundwater Problems. Part I: Deterministic Partial Differential Equations in Groundwater Flow. A Functional-Analytic Approach,
W87-02842 2F

Analysis of Stochastic Groundwater Flow Problems. Part II: Stochastic Partial Differential Equations in Groundwater Flow. A Functional-Analytic Approach,
W87-02843 2F

Analysis of Stochastic Groundwater Flow Problems. Part III: Approximate Solution of Stochastic Partial Differential Equations,
W87-02844 2F

Non-Darcian Transmission of Water in Certain Humified Peats,
W87-02846 2G

Evolution of a Single Wake Behind a Pair of Bluff Bodies,
W87-02862 2E

Stability of Flows in Channels with Small Wall Curvature,
W87-02863 8B

Stability Criterion of a Laminar Flow,
W87-02868 8B

Flow Processes of a Cutterhead Dredge,
W87-03262 8C

FLOW CONTROL
Management of Instream Flows through Runoff Detention and Retention,
W87-02934 4A

Flow Equalizing Saves Time and Money,
W87-03124 5D

FLOW-INJECTION ANALYSIS
Automated Prevalve Dilution in Flow-Injection Analysis: The Automated Determination of Chloride in Surface, Ground and Domestic Water,
W87-02793 5A

Fluorometric Determination of Nitrite in Natural Waters with 3-Aminonaphthalene-1,5-disulphonic Acid by Flow-Injection Analysis,
W87-03172 5A

FLOW MEASUREMENT
Experiments on Vertical Plane Buoyant Jets in Shallow Water,
W87-02762 8B

Analysis of the Velocity Field in a Boundary Layer Generated by a Water Wave, (Analyse du Champ des Vitesses dans la Couche Limite Generee par une Onde Progressive (Houle)),
W87-02790 8B

FLOW PATH
Performance of China's First Concrete Cut-off Wall,
W87-02689 8A

FLOW PATTERN
Comparison of MOBED and HEC-6 River Flow Models,
W87-02669 2E

FLOW RATES
Analysis of the Velocity Field in a Boundary Layer Generated by a Water Wave, (Analyse du Champ des Vitesses dans la Couche Limite Generee par une Onde Progressive (Houle)),
W87-02790 8B

FLOWERS
Interactive Effects of Trickle Irrigation Rates, Cultivars, and Culture on Cut Chrysanthemum,
W87-02959 3F

FLUCTUATIONS
Interpretation of Tracer Data in Variable Flow Systems,
W87-03070 7B

Benthic Fluxes of Cadmium, Copper, Nickel, Zinc and Lead in the Coastal Environment,
W87-03144 5B

FLUID MECHANICS
Evolution of a Single Wake Behind a Pair of Bluff Bodies,
W87-02862 2E

FLUORIDATION
Need for Fluoridation of Desalinated Water Supplies,
W87-03041 5F

Exposure to Fluoridated Public Water Supplies and Child Health and Behaviour,
W87-03092 5C

FLUORIDES
HPLC Anion Exclusion Method for Fluoride Determinations in Complex Effluents,
W87-03094 5A

FLUOROMETRY
Fluorometric Determination of Nitrite in Natural Waters with 3-Aminonaphthalene-1,5-disulphonic Acid by Flow-Injection Analysis,
W87-03172 5A

FLURIDONE
Fluridone Retention and Release in Soils,
W87-02918 5B

Liquid Chromatographic Determination of Fluridone Aquatic Herbicide and Its Metabolite in Fish and Crayfish,
W87-03113 5A

FLUVIAL PROCESSES
Fluvial Processes and Morphological Thresholds in Incised Channel Restoration,
W87-02930 2J

FOOD-PROCESSING WASTES
Salmonellae and Pollution Indicator Bacteria in Municipal and Food Processing Effluents and the Cornwallis River,
W87-02815 5D

FORAGE YIELD
Kleingrass Yield and Quality Under Three Irrigation Regimes When Harvested at Anthesis,
W87-02993 3F

FORAGES
Influence of Climatic Factors and Forage Age on the Chemical Components of Ryegrass Related to Grass Tetany,
W87-02980 2I

Kleingrass Yield and Quality Under Three Irrigation Regimes When Harvested at Anthesis,
W87-02993 3F

Drought Avoidance in Tall Fescue,
W87-03019 2I

FORECASTING
Evaluation of Weekly and Monthly Time Series Forecasts of Municipal Water Use,
W87-02629 6A

Estimating Snow Load in California for Three Recurrence Intervals,
W87-03336 2C

FOREST HYDROLOGY
Evaporation from the Understorey in the Jarrah (Eucalyptus Marginata Don Ex Sm.) Forest, Southwestern Australia,
W87-02679 2D

FOREST SOILS
Preferential Flow and Hydraulic Conductivity of Forest Soils,
W87-02724 2G

FOREST WATERSHEDS
Estimating Macroporosity in a Forest Watershed by use of a Tension Infiltrometer,
W87-02917 2G

FORESTS
Rates of Mineral Element Leaching from Leaves of Nine Plant Species from a Southern Appalachian Forest Succession Subjected to Simulated Acid Rain,
W87-03206 5C

Biogeochemical Controls on River Water Quality in a Forested Drainage Basin, Warwickshire, UK,
W87-03292 2E

FORT WORTH
Review of Selective Withdrawal Performance in the Fort Worth District,
W87-03229 6B

FOUNDATIONS
Geological Problems Overcome at Revelstoke: Part Two,
W87-02692 8D

Cordless Geo-Data Link,
W87-03031 7B

FRANCE
Metabolical Activity of Bacteria in Geothermal Spring-waters Dating from Dogger and Trias Periods in the Bassin Parisien, (Activites Metaboliques des Bacteries des Eaux Geothermales du Dogger et du Trias du Bassin Parisien),
W87-02562 5B

Distribution of Anionic Surfactants in the Water Column of the Gulf of Fos-sur-Mer, (Distribution des Detergents Anioniques dans la Colonne d'Eau du Golfe de Fos-sur-Mer),
W87-02563 5B

Overview of PCB Pollution and its Behavior in Seine River, (Apercu sur la Pollution par les P.C.B. (Polychlorobiphenyles) en Seine, et son Comportement),
W87-02564 5B

Few Data about Independent Producers of Hydroelectricity in France, (Quelques Donnees sur la Production Hydroelectrique Autonome en France),
W87-02567 8C

Problems Encountered in The Operation of Small Power Plants, (Problemes Rencontres a la Mise en Service de Microcentrales),
W87-02572 8C

Small Hydroelectric Plants and Environemental Protection, (Petite Hydraulique et Protection de l'Environment),
W87-02573 8C

Energy Recovery Small Hydro Plants on the Rhone River. The First Months of Operation of Champagneux Power Plant and the Sault-Brenaz Project, (Les Petites Centrales de Recuperation sur le Rhone. Les Premiers Mois d' Exploitation de la Centrale de Champagneux et le Project de Sault-Brenaz),
W87-02575 8C

Problem of Phosphorus in France - Its Presence in Natural Waters and Biological Phosphorus Removal,
W87-02734 5G

Study of Foamy Thermomineral Water of French Massif Central. I. Oxidation-reduction Potential and Behavior of Iron (Etude des eaux Thermominearales Carbogazeuses du Massif Central Francais. I. Potentiel d'Oxydo-Reduction et Comportement du Fer),
W87-03134 5B

Study of Foamy Thermomineral Water of French Massif Central. II. Behavior of Some Trace Metals, Arsenic, Antimony and Germanium, (Etude des Eaux Thermominerales Carbogazeuses du Massif Central Francais. II. Comportement de Quelques Metaux en Trace, de l'Arsenic, de l'Antimoine et du Germanium),
W87-03146 2K

Biomass and Structure of a Spartina alterniflora Loisel.-dominated Salt Marsh in France,
W87-03203 2L

Chemical Erosion Measurements in the Massif des Maures: The Example of the Rimbaud

Drainage Basin (Var, France)(Mesures de l'Erosion Chimique dans le Massif des Maures: l'Exemple du Basin Versant du Rimbaud (Var, France)),
W87-03294 2K

FREE SURFACE VORTICES
Designing Intakes to Avoid Free-Surface Vortices,
W87-03034 8B

FREE SURFACES
Mixing Coefficient for Ice-covered and Free-surface Flows,
W87-02671 2E

FREQUENCY ANALYSIS
Classification of Drainage Basins According to their Physical Characteristics; An Application for Flood Frequency Analysis in Scotland,
W87-02683 2E

Unbiased Plotting Positions for the General Extreme Value Distribution,
W87-03071 2E

Hydrologic Similarity: 1. Derivation of the Dimensionless Flood Frequency Curve,
W87-03194 2E

Value of Historical Data in Flood Frequency Analysis,
W87-03200 2E

FRESH WATER
Speciation of Manganese in Freshwaters,
W87-03051 2K

FRESHWATER
Mechanism of Inactivation of Enteric Viruses in Fresh Water,
W87-02893 5B

FRESHWATER ALGAE
Bioaccumulation of Arsenic by Freshwater Algae and the Application to the Removal of Inorganic Arsenic from an Aqueous Phase: Part II. by Chlorella vulgaris Isolated from Arsenic-Polluted Environment,
W87-02907 5B

FRESHWATER DISCHARGE
Zooplankton Fauna of Killary Harbour: The Seasonal Cycle of Abundance,
W87-03054 2L

FRIANT DAM
Alkali-Silica Reactivity in Five Dams in Southwestern United States,
W87-03319 8F

FRICTION
Bed Friction and Dissipation in a Combined Current and Wave Motion,
W87-03210 8B

FRONTAL REGIONS
Possible Role of Symmetric Instability in the Formation of Precipitation Bands,
W87-03213 2B

FRUIT CROPS
Dealing with the Drought,
W87-02565 3F

Integration of Water Stress in Fruit Trees,
W87-02952 2I

FRUIT QUALITY
Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. II. Mineral Composition of Fruit and Leaves, Fruit Disorders, and Fruit Set,
W87-03111 3F

FUNGI
Fungi in Potable Water Distribution Systems,
W87-02614 5B

Feasibility of Using Mycorrhizal Fungi for Enhancement of Plant Establishment on Dredged Material Disposal Sites: A Literature Review,
W87-03316 3D

GABON
Small Power Stations Abroad, (Aspects Specifiques de Minicentrales a l'Etranger),
W87-02566 8C

GAINESVILLE
Effects of Water Quality Parameters on the Corrosion of Galvanized Steel,
W87-02608 5G

GALLOWAY
Preliminary Model of Long-Term Changes in Stream Acidity in Southwestern Scotland,
W87-02682 5G

GALVANIZED STEEL
Effects of Water Quality Parameters on the Corrosion of Galvanized Steel,
W87-02608 5G

GALVESTON BAY
Development of a Method for Concentration of Rotavirus and Its Application to Recovery of Rotaviruses from Estuarine Waters,
W87-02896 5A

GAS CHROMATOGRAPHY
Determination of Acrylic Acid in Aqueous Samples by Electron Capture Gas Chromatography after Extraction with Tri-n-octylphosphine Oxide and Derivatization with Pentafluorobenzyl Bromide,
W87-02818 5A

Determination of Halogenated Solvent Residues in Water, Waste Water, Feeding-Stuffs, and Food, (Bestimmung halogenierter Losungsmittelruckstande in Wasser, Abwasser, Futter- und Lebensmitteln),
W87-03086 5A

GAS EXCHANGE
Gas Exchange of Field-Grown Soybean Under Drought,
W87-02999 2I

GATES
Self-closing Cylindrical Gate Improves Safety at Low Cost,
W87-02693 8C

GENOMIC ANALYSIS
Genomic Analysis of RNA Viruses Isolated from Water,
W87-02645 5A

GEOCHEMISTRY
Studies on Sediments of the River Lahn: 1. Analytical Results, (Untersuchungen an Lahnsedimenten: 1. Analytische Ergebnisse),
W87-02800 5B

Study of Foamy Thermomineral Water of French Massif Central. I. Oxidation-reduction Potential and Behavior of Iron (Etude des eaux Thermominearales Carbogazeuses du Massif Central Francais. I. Potentiel d'Oxydo-Reduction et Comportement du Fer),
W87-03134 5B

Geochemical and Environmental Processes Affecting Radionuclide Migration from a Formerly Used Seepage Trench,
W87-03135 5E

Geochemistry of Tin in Rivers and Estuaries,
W87-03140 5B

Biogeochemical Controls on River Water Quality in a Forested Drainage Basin, Warwickshire, UK,
W87-03292 2E

GEOHYDROLOGY
Saline- versus Freshwater Contribution to the Thermal Waters of the Northern Jordan Rift Valley, Israel,
W87-02852 2F

Groundwater Occurrences in the Hard Rock Terrains of Sri Lanka - A Case Study,
W87-03047 2F

GEOLOGY
Medical Geology,
W87-02825 5C

Groundwater Occurrences in the Hard Rock Terrains of Sri Lanka - A Case Study,
W87-03047 2F

Late Quaternary Alluvial Stratigraphy of Whitewater Draw, Arizona: Implications for Regional Correlation of Fluvial Deposits in the American Southwest,
W87-03209 8E

GEOPHYSICS
Aquifer Transmissivity of Porous Media from Resistivity Data,
W87-02837 7B

GEOTHERMAL RESOURCES
Metabolical Activity of Bacteria in Geothermal Spring-waters Dating from Dogger and Trias Periods in the Bassin Parisien, (Activites Metaboliques des Bacteries des Eaux Geothermales du Dogger et du Trias du Bassin Parisien),
W87-02562 5B

GEOTHERMAL STUDIES
Saline- versus Freshwater Contribution to the Thermal Waters of the Northern Jordan Rift Valley, Israel,
W87-02852 2F

GERMANIUM
Study of Foamy Thermomineral Water of French Massif Central. II. Behavior of Some Trace Metals, Arsenic, Antimony and Germanium, (Etude des Eaux Thermominerales Carbogazeuses du Massif Central Francais. II. Comportement de Quelques Metaux en Trace, de l'Arsenic, de l'Antimoine et du Germanium),
W87-03146 2K

GERMINATION
Salinity Tolerance of Winged Bean as Compared With That of Soybean,
W87-02988 3C

Growth and Nutritional Status of Petunia and Tomato Seedlings with Acidified Irrigation Water,
W87-03105 5C

Water or Salt Stress Increases Infectivity of Erysiphe pisi Conidia Taken from Stressed Plants,
W87-03175 5C

GHYBEN-HERZBERG PRINCIPLE
Comparison of the Coupled Fresh Water-Salt Water Flow and the Ghyben-Herzberg Sharp Interface Approaches to Modeling of Transient Behavior in Coastal Aquifer Systems,
W87-03077 2F

GLACIAL DRIFT
Environmental Factors Affecting the Acid Neutralization Capacity of Finnish Glacial Till Deposits,
W87-02588 5B

GLACIERS
Solute Yield From a Glacierized High Mountain Basin,
W87-03276 5B

GLUMSO LAKE
Validation of a Prognosis Based Upon a Eutrophication Model,
W87-02602 5C

GOITER
Prevention and Treatment of Endemic Iodine-Deficiency Goiter by Iodination of a Municipal Water Supply,
W87-02779 5F

GOVERNMENT FINANCE
Emerging Trends in Infrastructure Financing,
W87-02606 6C

GRAIN
Estimation of Spring Wheat Spike Water Concentration and Grain Maturity from Air Temperature,
W87-02998 2I

GRAIN CROPS
Effect of Standing Small Grain Stubble on Snow Cover Characteristics in Alternate Fallow Strip Cropping,
W87-02990 2C

Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-03009 2I

GRAIN STUBBLE
Effect of Standing Small Grain Stubble on Snow Cover Characteristics in Alternate Fallow Strip Cropping,
W87-02990 2C

GRAIN YIELD
Water Deficit During Panicle Development in Pearl Millet: Yield Compensation by Tillers,
W87-03157 2I

GRANITE
Response to Pumping of a Weathered-Fractured Granite Aquifer,
W87-02676 2F

GRANTS
History of the Federal-State Cooperative Water Resources Research Institute Program,
W87-02632 9D

GRAPES
Effect of Woven Plastic Mulch, Herbicides, Grass Sod, and Nitrogen on 'Foch' Grapes Under Irrigation,
W87-03106 3F

GRAPHICAL ANALYSIS
Graphic Plotting of the Relationships of Physical Characteristics of Soils,
W87-02871 8D

GRAPHICAL METHODS
Graphic Plotting of the Relationships of Physical Characteristics of Soils,
W87-02871 8D

GRASS SILAGE
Evaluation of Effluent from Grass Silage as a Feed for Beef Cattle Offered Silage-based Diets,
W87-03099 5E

GRASS SOD
Effect of Woven Plastic Mulch, Herbicides, Grass Sod, and Nitrogen on 'Foch' Grapes Under Irrigation,
W87-03106 3F

GRASSES
Salt Tolerance in the Triticeae: Salinity-Induced Changes in the Leaf Solute Composition of Some Perennial Triticeae,
W87-02785 2I

Effects of Pattern and Amount of Simulated Rainfall on Seedling Dynamics of Weeping Lovegrass and Kleingrass,
W87-03011 2I

GRASSLANDS
Microclimate of an Upland Grassland,
W87-03101 2I

Manurial Value of Septic-Tank Sludge on Grassland,
W87-03102 5E

GRAVEL
Transport of Gravel by Flows up to 500 cu m/s, Ohau River, Otago, New Zealand,
W87-02773 2J

Purification of Nho River by the Gravel Contact Method,
W87-03266 5G

GRAVEL BEDS
Erosion of Unconsolidated Gravel Beds,
W87-02673 2J

GRAVITY FLOW
Distribution Function Approach to Water Flow in Soil Macropores Based on Kinematic Wave Theory,
W87-02858 2G

GRAYSON LAKE
Selective Experiences: Alias Withdrawal Pains,
W87-03246 6B

GRAZING
Response to Waterlogging and Differing Sensitivity to Divalent Iron and Manganese in Clones of Dactylis glomerata L. Derived from Well-Drained and Poorly-Drained Soils,
W87-03095 5C

GREAT LAKES
Wildland Management on Point Pelee, Rondeau, and Long Point Peninsulas, Lake Erie,
W87-02591 6G

Metal Concentrations in the Annual Shell Layers of the Bivalve Elliptio complanata,
W87-02764 5B

GREECE
Mathematical Prediction of Thermal Stratification of Lake Ostrovo (Vegoritis), Greece,
W87-03198 2H

GREENHOUSE CULTIVATION
Nursery Irrigation-Syringe System That Monitors Environmental Parameters,
W87-03107 7C

GREENLAND
Placers of Cosmic Dust in the Blue Ice Lakes of Greenland,
W87-02913 2C

GROUNDWATER
Detection and Stability of Enteric Viruses in Sludge, Soil and Ground Water,
W87-02662 5B

Microbial Polymers in the Aquatic Environment-III: Isolation from River, Potable and Underground Water and Analysis,
W87-02696 5B

Immiscible Contaminant Transport in Soils and Groundwater with an Emphasis on Petroleum Hydrocarbons: System of Differential Equations vs Single Cell Model,
W87-02729 5B

Application of Aluminas in Water Treatment,
W87-02752 5D

Morphology of a Saline Groundwater Body: Its Investigation, Description and Possible Explanation,
W87-02849 2F

Comparative Analysis of Transmissivity and Hydraulic Conductivity Values from the Ajali Aquifer System of Nigeria,
W87-02859 2F

Regime of Ground Water of Semberian Aquifer,
W87-03043 2F

Groundwater Occurrences in the Hard Rock Terrains of Sri Lanka - A Case Study,
W87-03047 2F

Results of Pumping Tests in the Deccan Trap Basalts of Central India,
W87-03076 2F

137C-135C Variations in a Diffusion-Controlled Groundwater System,
W87-03149 5A

GROUNDWATER ALLOCATION
Ixtapa Draft Agreement Relating to the Use of Transboundary Groundwaters,
W87-02592 6E

GROUNDWATER BASINS
Mathematical Modelling for Multi-Aquifer Groundwater Basins,
W87-02848 2F

GROUNDWATER CONTAMINATION
Field Validation of the Contaminant Transport Model, FEMA,
W87-03089 5B

GROUNDWATER DATING
Tritium Corrected 14C and Atmospheric Noble Gas Corrected 4He Applied to Deduce Ages of Mixed Groundwaters: Examples from the Baden Region, Switzerland,
W87-03147 5A

GROUNDWATER HYDROLOGY
Saline- versus Freshwater Contribution to the Thermal Waters of the Northern Jordan Rift Valley, Israel,
W87-02852 2F

GROUNDWATER LEVEL
Hydrological Investigations of Dinaric Karst at the Krcic Catchment and the River Krka Springs (Yugoslavia),
W87-02845 2A

GROUNDWATER LEVELS
Analysis of Earth-Tide-Induced Groundwater Flow in Eastern Botswana,
W87-02840 2F

Efficient Response Matrix Method for Coupling a Groundwater Simulator and a Regional Agricultural Management Model,
W87-02936 4B

GROUNDWATER MANAGEMENT
Location of an Interface Observation Well: A Bayesian Approach,
W87-03187 2F

Plan for Protecting Illinois Groundwater.
W87-03331 6B

GROUNDWATER MODELS
Examination of the Mechanisms Controlling Groundwater Gradients in Hyper-Arid Regional Sedimentary Basins,
W87-02942 2F

GROUNDWATER MOVEMENT
Response to Pumping of a Weathered-Fractured Granite Aquifer,
W87-02676 2F

GROUNDWATER MOVEMENT

Hydrogen Isotope Study of Large-Scale Meteoric Water Transport in Northern California and Nevada,
W87-02686 2F

Hydraulic Conductivity and Related Physical Properties of Peat, Lost River Peatland, Northern Minnesota,
W87-02715 2G

Analysis of Earth-Tide-Induced Groundwater Flow in Eastern Botswana,
W87-02840 2F

Analysis of Stochastic Groundwater Problems. Part I: Deterministic Partial Differential Equations in Groundwater Flow. A Functional-Analytic Approach,
W87-02842 2F

Analysis of Stochastic Groundwater Flow Problems. Part II: Stochastic Partial Differential Equations in Groundwater Flow. A Functional-Analytic Approach,
W87-02843 2F

Analysis of Stochastic Groundwater Flow Problems. Part III: Approximate Solution of Stochastic Partial Differential Equations,
W87-02844 2F

Non-Darcian Transmission of Water in Certain Humified Peats,
W87-02846 2G

Simple Approximation for a Moving Interface in a Coastal Aquifer,
W87-02851 2F

Comparative Analysis of Transmissivity and Hydraulic Conductivity Values from the Ajali Aquifer System of Nigeria,
W87-02859 2F

Examination of the Mechanisms Controlling Groundwater Gradients in Hyper-Arid Regional Sedimentary Basins,
W87-02942 2F

Interpretation of Tracer Data in Variable Flow Systems,
W87-03070 7B

Transport of Conservative Tracers in the Field Under Intermittent Flood Irrigation,
W87-03191 2G

Finite-Element Collocation Method for Variably Saturated Flow in Two Space Dimensions,
W87-03192 2F

Groundwater Seepage Vectors and the Potential for Hillslope Failure and Debris Flow Mobilization,
W87-03193 2F

Upstream Weight Multiple-Cell Balance Finite-Element Method for Solving Three-Dimensional Convection-Dispersion Equations,
W87-03197 2F

Drains as a Boundary Condition in Finite Elements,
W87-03201 2F

GROUNDWATER POLLUTION

Metabolical Activity of Bacteria in Geothermal Spring-waters Dating from Dogger and Trias Periods in the Bassin Parisien, (Activites Metaboliques des Bacteries des Eaux Geothermales du Dogger et du Trias du Bassin Parisien),
W87-02562 5B

Distribution of Anionic Surfactants in the Water Column of the Gulf of Fos-sur-Mer, (Distribution des Detergents Anioniques dans la Colonne d'Eau du Golfe de Fos-sur-Mer),
W87-02563 5B

Adsorption of Select Phenol Derivatives by Dolomite,
W87-02583 5B

Alternatives to the Use of Agricultural Drainage Wells,
W87-02624 4B

Cost of Pure Water,
W87-02642 5G

Viruses and Bacteria in a Chalk Well,
W87-02655 5B

High Concentration of Solutes at the Upper Part of the Saturated Zone (Water Table) of a Deep Aquifer Under Sewage-Irrigated Land,
W87-02677 2F

Sorption of Hydrophobic Trace Organic Compounds in Groundwater Systems,
W87-02730 5B

Retardation of Toxic Chemicals in a Contaminated Outwash Aquifer,
W87-02731 5B

In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-02754 5G

Groundwater Contamination with Synthetic Organic Compounds and Pesticides in Suffolk County,
W87-02827 5B

Model Simulation of Solute Leaching and Its Application for Estimating the Net Rate of Nitrate Formation under Field Conditions,
W87-02839 5B

Continuous Monitoring of 222Rn Concentration in Unconfined Groundwater,
W87-02847 5A

Modeling Leachate Production from Municipal Landfills,
W87-02883 5B

Fertilizers Suitable for the Environment as Part of a Reorientation in Agricultural Policy,
W87-03040 5G

Field Validation of the Contaminant Transport Model, FEMA,
W87-03089 5B

Sources of Nitrate to Ground Water,
W87-03130 5B

Groundwater: Its Occurrence, Movement and Potential for Pollution,
W87-03309 2F

GROUNDWATER QUALITY

Microbiology of Subsurface Environments.
W87-03325 2F

GROUNDWATER RECHARGE

Examination of the Mechanisms Controlling Groundwater Gradients in Hyper-Arid Regional Sedimentary Basins,
W87-02942 2F

GROUNDWATER SIMULATOR

Efficient Response Matrix Method for Coupling a Groundwater Simulator and a Regional Agricultural Management Model,
W87-02936 4B

GROUT CURTAIN

Performance of China's First Concrete Cut-off Wall,
W87-02689 8A

GROUTING

Use of Grouting When Driving Through the Rock Burst Zone in the Dangara Irrigation Tunnel,
W87-03181 8E

GROWING SEASON

Response of Conservation Tillage Sorghum to Growing Season Precipitation,
W87-03167 3F

GROWTH

Orthanilic Acid and Analogues as Carbon Sources for Bacteria: Growth Physiology and Enzymic Desulphonation,
W87-02781 5D

Growth of Salmonellas in Different Enrichment Media,
W87-02786 5A

Effects of Temperature, Salinity, Irradiance and Diurnal Periodicity on Growth and Photosynthesis in the Diatom Nitzschia americana: Light-Saturated Growth,
W87-02807 2L

Underwater Light Climate and the Growth and Pigmentation of Planktonic Blue-Green Algae (Cyanobacteria) I. The Influence of light quantity,
W87-02908 2H

GROWTH CHAMBERS

Effect of Short-term Water Stress on Leaf Gas Exchange Processes and Plant Water Potential in Schefflera,
W87-03104 2I

GROWTH RATE

Effects of Light on Growth, RuBPCase Activity and Chemical Composition of Ulva Species (Chlorophyta),
W87-02809 2L

GROWTH RATES

Relationships Among Growth Rate, Cellular Manganese Concentrations and Manganese Transport Kinetics in Estuarine and Oceanic Species of the Diatom Thalassiosira,
W87-02805 2L

Underwater Light Climate and the Growth and Pigmentation of Planktonic Blue-green Algae (Cyanobacteria) II. the Influence of Light Quality,
W87-02909 2H

GULLS

Levels of Chlorinated Hydrocarbons and Composition of PCB in Herring Gull Larus argentatus Eggs Collected in Norway in 1969 Compared to 1979-81,
W87-02585 5B

HABITATS

Stemming the Loss of Coastal Wetland Habitats: Jamaica as a Model for Tropical Developing Countries,
W87-03128 2L

HALOGENATED PHENOLS

Halogenated Phenols in Water at Forty Canadian Potable Water Treatment Facilities,
W87-03112 5F

HALOPHYTES

Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: I. Salinity During Growth Modulates the Proton Pump in the Halophyte Atriplex Nummularia,
W87-02717 2I

Effects of Seawater on Amino Acids and Mineral Ions Composition in Salicornia brachiata Roxb,
W87-03093 3C

HANDBOOKS
Floodplain Management Handbook.
W87-03330 6F

HARBORS
Legal System and Works for Preservation of the Port, Harbour, and Marine Environment in Japan,
W87-03249 5G

HARDNESS
Lime-Cement Hardening of Very Soft Freshwater Clay,
W87-03260 8D

HARIMA-NADA
Modelling of the Lower Trophic Levels of a Marine Ecosystem and Its Example of Short-period Variations of Chlorophyll and Nutrient in Harima-Nada,
W87-02601 2L

HARMONIC REGRESSION
Statistical Technique for Analysis of Environmental Data Containing Periodic Variance Components,
W87-02599 7C

HARROWING
Mechanized Tillage Systems Effects on Properties of a Tropical Alfisol in Watersheds Cropped to Maize,
W87-03162 2G

HEAD LOSS
Effect of the Shape of the Transition Section on Head Losses in Intakes of a Pumped-Storage Station,
W87-02867 8A

HEADWORKS
Geological Problems Overcome at Revelstoke: Part Two,
W87-02692 8D

HEALTH HAZARDS
Chemistry of Tap Water in Sri Lanka - Implications on Health,
W87-03026 5F

HEALTH SERVICES
Modelling of Industrial Ecological Systems for Evaluation of Health Services,
W87-02979 4C

HEAVY METALS
Metal Concentrations in the Annual Shell Layers of the Bivalve Elliptio complanata,
W87-02764 5B

Nitrilotriacetic Acid in Sludge-amended Soil: Mobility and Effects on Metal Solubility,
W87-02765 5E

Toxicity of Brass Dust to the Microalgae Ankistrodesmus falcatus and Selenastrum capricornutum,
W87-02778 5C

Possibilities of Improving the Determination of Extremely Low Lead Concentrations in Marine Fish by Graphite Furnace Atomic Absorption Spectrometry,
W87-02794 5A

Determination of Lead, Cadmium and Thallium in Water Samples at ppb and ppt Levels by Isotope Dilution Mass Spectrometry, (Bestimmung von Blei, Cadmium und Thallium in Wasserproben im ppb- und ppt-Bereich durch massenspektrometrische Isotopenverdunnungsanalyse),
W87-02795 5A

Multielement Trace Preconcentration from Water on Activated Carbon for the Sample Pretreatment for Atomic Spectroscopy (Flame-AAS, ICP/OES), (Multielement-Spurenanreicherung aus Wassern an Aktivkohle zur Probenvorbereitung fur die Atomspektroskopie (Flammen-AAS, ICP/OES)),
W87-02799 5A

Studies on Sediments of the River Lahn: 1. Analytical Results, (Untersuchungen an Lahnsedimenten: 1. Analytische Ergebnisse),
W87-02800 5B

Studies on Sediments of the River Lahn: 2. Chemometric Evaluation, (Untersuchungen an Lahnsedimenten: 2. Chemometrische Auswertung),
W87-02801 5B

Selective Preconcentration of Copper from Aqueous Solution by Using Kerateine Gel,
W87-02802 5A

Acute and Chronic Toxicity of Nickel to Larvae of Chironomus riparis (Meigen),
W87-03083 5C

Interlaboratory Comparison of Analyses for Heavy Metals in Clam Tissue,
W87-03114 5A

Flame Absorption Spectroscopic Determination of Cadmium, Copper, Iron, Lead, and Zinc in Mussels,
W87-03115 5A

Functional Design of Activated Sludge Processes with Heavy Metal Inhibition,
W87-03131 5D

Micronutrient Tolerance and Accumulation in the Duckweed, Lemna,
W87-03153 5C

Determination of Organically-associated Trace Metals in Estuarine Sea-Water by Solvent Extraction and Atomic-Absorption Spectrometry,
W87-03173 5A

Heavy Metal Content in Sediments of Lakes in Southern Bavaria as a Sign of Long-Term Environmental Impact,
W87-03305 5C

HELIUM RADIOISOTOPES
Tritium Corrected 14C and Atmospheric Noble Gas Corrected 4He Applied to Deduce Ages of Mixed Groundwaters: Examples from the Baden Region, Switzerland,
W87-03147 5A

HERBICIDES
Herbicides and Seeding Rate Effects on Sprinkler-Irrigated Rice,
W87-03013 2I

Effect of Woven Plastic Mulch, Herbicides, Grass Sod, and Nitrogen on 'Foch' Grapes Under Irrigation,
W87-03106 3F

Mechanized Tillage Systems Effects on Properties of a Tropical Alfisol in Watersheds Cropped to Maize,
W87-03162 2G

HETEROGENEOUS SOILS
Stochastic Approach to the Crop Yield-Irrigation Relationships in Heterogeneous Soils: I. Analysis of the Field Spatial Variability,
W87-02921 3F

HIGH PERFORMANCE LIQUID CHROMATOGRAPHY
HPLC Anion Exclusion Method for Fluoride Determinations in Complex Effluents,
W87-03094 5A

HIGHLANDS
Environmental Chemistry of Rainwater in Sri Lanka,
W87-03023 2B

HIGHWAY RUNOFF
Nutrient Transformation in Retention/Detention Ponds Receiving Highway Runoff,
W87-02821 5D

Pollutants Associated with Sand and Salt Applied to Roads in Minnesota,
W87-02943 5B

HIROSHIMA BAY
Determination of Organically-associated Trace Metals in Estuarine Sea-Water by Solvent Extraction and Atomic-Absorption Spectrometry,
W87-03173 5A

HISTORIC FLOODS
Value of Historical Data in Flood Frequency Analysis,
W87-03200 2E

HISTORY
History of the Federal-State Cooperative Water Resources Research Institute Program,
W87-02632 9D

Water and the Third Millennium,
W87-03044 5F

Historic Trends in the Sediment Flow Regime of the Mississippi River,
W87-03195 2J

HORIZONTAL FLOW
Vertical-Horizontal Transport and Fate of Low Water Solubility Chemicals in Unsaturated Soils,
W87-03074 2G

HORTON EQUATION
Explicit Solution of the Modified Horton Equation,
W87-02850 2G

HUDSON RIVER
Ecology and Estuarine Impact Assessment: Lessons Learned from the Hudson River (U.S.A.) and Other Estuarine Experiences,
W87-02776 2L

HUMAN DISEASES
Detection of Hepatitis A Virus (HAV) in Drinking Water,
W87-02646 5A

Human Viruses in Sediments, Sludges, and Soils,
W87-02768 5B

Application of Environmental Management Principles in the Program for Eradication of Aedes (Stegomyia) aegypti (Linneus, 1762) in the Republic of Cuba, 1984,
W87-02824 5G

HUMAN POPULATION
Water and the Third Millennium,
W87-03044 5F

HUMIC ACIDS
Humic Acid Interference with Virus Recovery by Electropositive Microporous Filters,
W87-02900 5A

HUMID AREAS
Corn Irrigation Scheduling in Humid Regions on Sandy Soils with Tillage Pans,
W87-02981 3F

HUMID CLIMATES
Corn Yield Response to Irrigation, Plant Population and Nitrogen in a Cool, Humid Climate,
W87-02878 3F

HUNGARY
Principles Underlying the Development of Water Quality Monitoring Systems in Hungary,
W87-03303 7A

HYDRAULIC CONDUCTIVITY
Preferential Flow and Hydraulic Conductivity of Forest Soils,
W87-02724 2G

Aquifer Transmissivity of Porous Media from Resistivity Data,
W87-02837 7B

HYDRAULIC DESIGN
Large Pelton Turbines for Canada's Cat Arm Scheme,
W87-02688 8C

Passive Screen Water Intake Design Studies,
W87-02767 8I

Method of Investigating the Compactibility of Cohesive Soils,
W87-02865 8D

Effect of the Shape of the Transition Section on Head Losses in Intakes of a Pumped-Storage Station,
W87-02867 8A

Pakem Hydro Development on the Pakem River,
W87-02870 8A

Dimensionless Analysis of Optimum Designs,
W87-03185 8A

Hydraulic Design of the Selective Withdrawal Structures of the Lost Creek Dam,
W87-03223 8A

Hydraulic Design of the Selective Withdrawal Structures of the Applegate Dam,
W87-03224 8A

Hydraulic Design of the Selective Withdrawal Structures at the Elk Creek Dam,
W87-03225 8A

Thoughts and Considerations for Hydraulic Design,
W87-03241 8B

HYDRAULIC ENGINEERING
RCC: A Dam Rehab Solution Unearthed,
W87-02770 8F

Effect of the Shape of the Transition Section on Head Losses in Intakes of a Pumped-Storage Station,
W87-02867 8A

Stability Criterion of a Laminar Flow,
W87-02868 8B

Pakem Hydro Development on the Pakem River,
W87-02870 8A

HYDRAULIC EQUIPMENT
Standardized Design and Units for Small Hydroprojects 10 to 20 m Head, (Projets et Materiels Standards pour Petits Amenagements Hydrauliques de 10 a 20 m de Chute),
W87-02576 8C

Overpressure Peak in Dual Horizontal Francis Turbines: Industrial Experiments Results, (Pic de Surpression des Francis Horizontales Doubles: Resultats d'Experiences Industrielles),
W87-02578 8C

Influence of the Runner Blade Angle Variation on Kaplan Turbine Transients, (Influence de la Variation d'Inclinaison des Pales sur les Regimes Transitoires des Turbines Kaplan),
W87-02579 8C

HYDRAULIC MACHINERY
Problems Encountered in The Operation of Small Power Plants, (Problemes Rencontres a la Mise en Service de Microcentrales),
W87-02572 8C

Delay of Reaction Turbines and Pumps to Transient States, (Retard des Turbines a Reaction et des Pompes dans Leur Comportement en Regime Transitoire),
W87-02581 8C

Experience in Creating Mechanical Equipment for Northern Hydroelectric Stations,
W87-03178 8C

Flow Processes of a Cutterhead Dredge,
W87-03262 8C

Tunnels: Machine Excavation - Rate of Progress - Machine Data,
W87-03320 8A

HYDRAULIC MODELS
Infiltration and Water Extraction from Trickle Irrigation Source: The Effective Hemisphere Model,
W87-02725 2G

Designing Intakes to Avoid Free-Surface Vortices,
W87-03034 8B

Flow Processes of a Cutterhead Dredge,
W87-03262 8C

Lock and Dam 1, Red River Waterway: Hydraulic Model Investigation,
W87-03333 8B

Burlington Spillway and Outlet Works Souris River, North Dakota: Hydraulic Model Investigation,
W87-03334 8B

Mill Creek Channel, Walla Walla, Washington: Hydraulic Model Investigation,
W87-03335 8B

HYDRAULIC PROPERTIES
Comparison of Steady Infiltration Solutions for Spherical Cavities Under Simple Versus Variable Hydraulic Properties,
W87-02712 2G

Riprap Stability and Navigation Tests for the Divide-Cut Section Tennessee-Tombigbee Waterway,
W87-03317 8A

HYDRAULIC STRUCTURES
Passive Screen Water Intake Design Studies,
W87-02767 8I

Effective Technology of Constructing Earth Structures,
W87-02864 8A

Experiencein the Manufacture and Installation of the Reinforced Concrete-Encased Steel Pipelines of the Zagorsk Pumped-Storage Station,
W87-02869 8A

Restoration of Pipe Drainage in Foundations of Hydraulic Structures on Carbonate Rocks,
W87-03184 8A

Thoughts and Considerations for Hydraulic Design,
W87-03241 8B

Selective Withdrawal Structure Operation Experiences in ORD,
W87-03243 8A

Effects of Hydraulic Projects and Their Management on Water Quality,
W87-03297 6G

HYDRAULIC TRANSIENTS
Computation of Hydraulic Transients in Complex Hydro Schemes,
W87-03036 8A

HYDRAULIC TURBINE RUNNERS
Materials Technology for Turbine Performance,
W87-02687 8C

HYDRAULICS
Experiments on Vertical Plane Buoyant Jets in Shallow Water,
W87-02762 8B

Evolution of a Single Wake Behind a Pair of Bluff Bodies,
W87-02862 2E

Hydraulics of Rectangular Clarifiers,
W87-02886 8B

HYDROCARBONS
Immiscible Contaminant Transport in Soils and Groundwater with an Emphasis on Petroleum Hydrocarbons: System of Differential Equations vs Single Cell Model,
W87-02729 5B

Thermodynamic Study of Solutions of Liquid Hydrocarbon Mixtures in Water,
W87-03145 1B

HYDRODYNAMIC MODELS
Three-dimensional Water-Quality-Transport Model Compared with Field Observations,
W87-02970 2H

HYDRODYNAMICS
Recent Advances in the Computation of Nonlinear Wave Effects on Offshore Structures,
W87-02668 8B

Analysis of the Velocity Field in a Boundary Layer Generated by a Water Wave, (Analyse du Champ des Vitesses dans la Couche Limite Generee par une Onde Progressive (Houle)),
W87-02790 8B

Evolution in Space and Time of an Alluvial Aquifer under the Effect of an Exceptional Multi-Year Drought (Mediterranean Shore, Herault, France) (Evolution Spatio-Temporelle d'un Aquifere Alluvial sous l'Effet d'une Secheresse Pluriannuelle Exceptionnelle (Littoral Mediterraneen, Herault, France)),
W87-02838 2F

Evolution of a Single Wake Behind a Pair of Bluff Bodies,
W87-02862 2E

HYDROELECTRIC PLANTS
Small Power Stations Abroad, (Aspects Specifiques de Minicentrales a l'Etranger),
W87-02566 8C

Creation of a Cross-Flow Turbines Range, (Creation d'une Gamme de Turbines a Flux Traversant),
W87-02569 8C

Small Hydroelectric Power Plants for Very Low Heads, (Les Usines de Tres Basse Chute en Mini-Hydroelectricite),
W87-02571 8C

Small Hydroelectric Plants and Environemental Protection, (Petite Hydraulique et Protection de l'Environment),
W87-02573 8C

Energy Recovery Small Hydro Plants on the Rhone River. The First Months of Operation of Champagneux Power Plant and the Sault-Brenaz Project, (Les Petites Centrales de Recuperation sur le Rhone. Les Premiers Mois d' Exploitation

de la Centrale de Champagneux et le Project de Sault-Brenaz),
W87-02575 8C

Materials Technology for Turbine Performance,
W87-02687 8C

65 MW Bulb Turbine for Japan's Tadami Project,
W87-02691 8C

Real-Time Kinematic Catchment Model for Hydro Operation,
W87-02766 2E

Characteristics of the Static Performance of Dams Reservoired Hydroelectric Stations,
W87-02866 8A

Effect of the Shape of the Transition Section on Head Losses in Intakes of a Pumped-Storage Station,
W87-02867 8A

Experiencein the Manufacture and Installation of the Reinforced Concrete-Encased Steel Pipelines of the Zagorsk Pumped-Storage Station,
W87-02869 8A

Pakem Hydro Development on the Pakem River,
W87-02870 8A

Data Processing for Hydro Plant Control,
W87-03033 8C

Automation of a Chain of Run-of-River Power Stations,
W87-03035 8C

Comparison of Various Methods of Controlling the Long-Term Operating Regimes of Hydroelectric Stations,
W87-03176 8C

Experience of Using the Turbine-Generator Units of the Kolyma Hydroelectric Station for Idle Discharge of Water,
W87-03177 8C

Experience in Creating Mechanical Equipment for Northern Hydroelectric Stations,
W87-03178 8C

Low-Head Pumped-Storage Station as a Way of Expanding the Tsimlyansk Hydroelectric Station,
W87-03182 8C

HYDROELECTRIC POWER

Standardized Design and Units for Small Hydroprojects 10 to 20 m Head, (Projets et Materiels Standards pour Petits Amenagements Hydrauliques de 10 a 20 m de Chute),
W87-02576 8C

Computation of Hydraulic Transients in Complex Hydro Schemes,
W87-03036 8A

Drought and Power Production,
W87-03060 6D

Comparison of Various Methods of Controlling the Long-Term Operating Regimes of Hydroelectric Stations,
W87-03176 8C

HYDROGEN

Effect of O2 Concentration on Dark H2 Oxidation in Whole Cells of a Marine Sulfur Photosynthetic Bacterium (Chromatium sp. Strain Miami PBS 1071),
W87-03211 2L

HYDROGEN ION COCNENTRATION

Boron Tolerance and Accumulation in the Duckweed, Lemna minor,
W87-03152 5C

HYDROGEN ION CONCENTRATION

Decomposition Studies in Two Central Ontario Lakes Having Surficial pHs of 4.6 and 6.6,
W87-02897 2H

Effects of Corrosion Control of Low Alkalinity Waters - Norwegian Experiences,
W87-03045 5F

Predicting Standard pH Values for Reference Buffer Solutions in Solvent Mixtures with Water,
W87-03049 5A

HYDROGEN ISOTOPES

Organic Water: Isotopic Characterization and Evidence for Its Role in the Fedj-el-Adoum Pb-Zn Deposit, Tunisia (Eau organique: caracterisation isotopique et evidence de son role dans le gisement Pb-Zn de Fedj-el-Adoum, Tunisie),
W87-03090 5B

HYDROGEN PEROXIDE

Two-Method Verification of Hydrogen Peroxide Determinations in Natural Waters,
W87-03050 5A

HYDROGRAPH ANALYSIS

Effect of Rainfall Excess Calculations on Modeled Hydrograph Accuracy and Unit-Hydrograph Parameters,
W87-02623 2B

HYDROGRAPHS

Effect of Rainfall Excess Calculations on Modeled Hydrograph Accuracy and Unit-Hydrograph Parameters,
W87-02623 2B

HYDROLOGIC BUDGET

Evaporation from the Understorey in the Jarrah (Eucalyptus Marginata Don Ex Sm.) Forest, Southwestern Australia,
W87-02679 2D

Analysis and Cartographical Approach to the Regional Water Utilization System in the Yodo River Basin,
W87-02978 6D

Budget of Water and Its Constituents for Lake Taupo (New Zealand),
W87-03295 2H

HYDROLOGIC BUDGET MODELS

Corn Irrigation Scheduling in Humid Regions on Sandy Soils with Tillage Pans,
W87-02981 3F

HYDROLOGIC MODELS

Analysis of Earth-Tide-Induced Groundwater Flow in Eastern Botswana,
W87-02840 2F

Mathematical Modelling for Multi-Aquifer Groundwater Basins,
W87-02848 2F

Hydrologic Similarity: 1. Derivation of the Dimensionless Flood Frequency Curve,
W87-03194 2E

HYDROLOGY

Aquifer Transmissivity of Porous Media from Resistivity Data,
W87-02837 7B

Modified Diffusion Equation for Flood Propagation in Trapezoidal Channels,
W87-02855 2E

Compaction, Hydrological Processes and Soil Erosion on Loamy Sands in East Shropshire, England,
W87-03160 2J

HYDROMETALLURGY

Hydrometallurgy: Winning Metals with Water,
W87-02618 5G

HYDROMORPHIC SOILS

Soil Water Balance of Intercropped Maize and Cowpea Grown in a Tropical Hydromorphic Soil in Western Nigeria,
W87-02989 2I

HYDROPHILIC FUNCTIONAL GROUPS

Prediction of the Distribution Constant of some Solutes Containing Hydrophilic Functional Groups from Data on the Solubility of Water in Organic Solvents,
W87-02906 1B

HYDROPONICS

Responses of Lettuce to Salinity. I. Effects of NaCl and Na2SO4 on Growth,
W87-03154 5C

HYPOLIMINION

Study of Dissolved Oxygen Budgets in Natural and Artificial Lakes,
W87-02976 2H

HYPOMAGNESEMIA

Influence of Climatic Factors and Forage Age on the Chemical Components of Ryegrass Related to Grass Tetany,
W87-02980 2I

HYSTERESIS

Combined Effect of Hysteresis and Temperature on Soil-Water Movement,
W87-02857 2G

ICE-COVERED FLOW

Mixing Coefficient for Ice-covered and Free-surface Flows,
W87-02671 2E

IDAHO

Fishing from the Bank: Public Recreational Rights along Idaho's Rivers and Lakes,
W87-02594 6E

ILLINOIS

Toxicity Tests of Aquatic Pollutants by Using Common Duckweed,
W87-02582 5A

Plan for Protecting Illinois Groundwater.
W87-03331 6B

IMMISCIBILITY

Immiscible Contaminant Transport in Soils and Groundwater with an Emphasis on Petroleum Hydrocarbons: System of Differential Equations vs Single Cell Model,
W87-02729 5B

IMMUNOASSAY

Detection of Hepatitis A Virus in Drinking Water by Enzyme-Immunoassay Using Ultracentrifugation for Virus Concentration,
W87-02647 5A

IMPAIRED WATER QUALITY

Red Alder Leaf Litter and Streamwater Quality in Western Oregon,
W87-02631 5B

IMPAIRED WATER USE

Response of Lettuce Cultivars to Sludge-Amended Soils and Bed Types,
W87-02880 3C

Production Function for Cotton with Dated Irrigation Quantities and Qualities,
W87-03189 3F

IMPOSEX

Decline of the Gastropod Nucella lapillus Around South-West England: Evidence for the Effect of Tributyltin from Antifouling Paints,
W87-03053 5C

INACTIVATION
Mechanism of Inactivation of Enteric Viruses in Fresh Water,
W87-02893 5B

Method for Determining Virus Inactivation During Sludge Treatment Processes,
W87-02898 5A

INCISED CHANNEL
Fluvial Processes and Morphological Thresholds in Incised Channel Restoration,
W87-02930 2J

INDIA
Emergence of Environmental Law in the Developing Countries: A Case Study of India,
W87-02616 6E

Results of Pumping Tests in the Deccan Trap Basalts of Central India,
W87-03076 2F

Trend Analysis of Water Quality in the Sabarmati River at Ahmedabad for a Decade (1969-1978),
W87-03278 5G

Factors Controlling the Chemical Composition of River Waters of India,
W87-03285 2E

INDICATORS
Behaviour of Coliphages in Oxidation Ponds,
W87-02666 5D

INDIRECT ATOMIC ABSORPTION SPECTROSCOPY
Indirect Atomic Absorption Determination of Anionic Surfactants in Wastewaters by Flow Injection Continuous Liquid-Liquid Extraction,
W87-03048 5A

INDUS RIVER
Nature of Particulate Organic Matter in the River Indus, Pakistan,
W87-03148 5A

INDUSTRIAL WASTEWATER
Effects of Cyanide on the Methanogenic Degradation of Phenolic Compounds,
W87-02709 5D

Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-02751 5D

Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial Wastewater Reuse and Priority Pollutant Removal,
W87-02753 5D

Anaerobic Treatment of Coke Plant Waste Water,
W87-02783 5D

INDUSTRIAL WATER
Analysis and Cartographical Approach to the Regional Water Utilization System in the Yodo River Basin,
W87-02978 6D

Structural Change Implications for Industrial Water Use,
W87-03190 6D

INDUSTRY
Modelling of Industrial Ecological Systems for Evaluation of Health Services,
W87-02979 4C

INFECTIVITY
Water or Salt Stress Increases Infectivity of Erysiphe pisi Conidia Taken from Stressed Plants,
W87-03175 5C

INFILTRATION
Hydrology of a Sloping, Structured Clay Soil at Wytham, Near Oxford, England,
W87-02685 2G

Comparison of Steady Infiltration Solutions for Spherical Cavities Under Simple Versus Variable Hydraulic Properties,
W87-02712 2G

Infiltration and Water Extraction from Trickle Irrigation Source: The Effective Hemisphere Model,
W87-02725 2G

Soil Potential Ratings for Onsite Wastewater Disposal,
W87-02860 5E

Polyacrylamide Application in Irrigation Water to Increase Infiltration,
W87-02911 2G

Temperature Dependence of Soil Water Retention Curves,
W87-02914 2G

Air Encapsulation: I. Measurement in a Field Soil,
W87-02915 2G

Air Encapsulation: II. Profile Water Storage and Shallow Water Table Fluctuations,
W87-02916 2F

Goodness of Fit for Eight Water Infiltration Models,
W87-02923 2G

INFILTRATION CAPACITY
Explicit Solution of the Modified Horton Equation,
W87-02850 2G

INFILTRATION RATE
Explicit Solution of the Modified Horton Equation,
W87-02850 2G

INFLUENT WATER
Effect of Influent Phosphorus Reductions on Great Lakes Sewage Treatment Costs,
W87-02630 5D

INFORMATION EXCHANGE
History of the Federal-State Cooperative Water Resources Research Institute Program,
W87-02632 9D

Risk Information for Floodplain Management,
W87-03061 6F

Evolution of PMP Cooperative Studies,
W87-03063 8A

INFRASTRUCTURE FINANCING
Emerging Trends in Infrastructure Financing,
W87-02606 6C

INHIBITION
Functional Design of Activated Sludge Processes with Heavy Metal Inhibition,
W87-03131 5D

INLET WELLS
Blending in a Single Wet Well,
W87-03236 5G

INORGANIC ARSENIC
Bioaccumulation of Arsenic by Freshwater Algae and the Application to the Removal of Inorganic Arsenic from an Aqueous Phase: Part II. by Chlorella vulgaris Isolated from Arsenic-Polluted Environment,
W87-02907 5B

INSECT CONTROL
Application of Environmental Management Principles in the Program for Eradication of Aedes (Stegomyia) aegypti (Linneus, 1762) in the Republic of Cuba, 1984,
W87-02824 5G

INSECTICIDES
Absence of Acclimation to Parathion by Rainbow Trout During Sublethal Exposure,
W87-02697 5C

Insecticides and Metals in Nigerian Surface Water - Warri River,
W87-03028 5B

INSTABILITY
Possible Role of Symmetric Instability in the Formation of Precipitation Bands,
W87-03213 2B

INSTALLATION
Experiencein the Manufacture and Installation of the Reinforced Concrete-Encased Steel Pipelines of the Zagorsk Pumped-Storage Station,
W87-02869 8A

INSTREAM FLOW METHODS
Review and Analysis of Methods for Quantifying Instream Flow Requirements,
W87-02933 6D

INSTREAM FLOW REQUIREMENTS
Review and Analysis of Methods for Quantifying Instream Flow Requirements,
W87-02933 6D

INSTREAM FLOWS
Management of Instream Flows through Runoff Detention and Retention,
W87-02934 4A

INTAKE GATES
Modeling of Selective Withdrawal Intake Structures,
W87-03230 5G

INTAKE TOWERS
Determination of Selective Withdrawal System Capacity for Intake Tower Design,
W87-03234 5G

INTAKES
Passive Screen Water Intake Design Studies,
W87-02767 8I

Effect of the Shape of the Transition Section on Head Losses in Intakes of a Pumped-Storage Station,
W87-02867 8A

Designing Intakes to Avoid Free-Surface Vortices,
W87-03034 8B

Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures.
W87-03221 8A

Design of Selective Withdrawal Intake Structures,
W87-03237 8A

Field Measurements at Intake Structures,
W87-03240 8B

INTERAGENCY COOPERATION
Stream Improvements and Fish Response: A Bio-engineering Assessment,
W87-02932 4A

INTERMITTENT IRRIGATION
Nursery Irrigation-Syringe System That Monitors Environmental Parameters,
W87-03107 7C

INTERNATIONAL CONFLICTS
Water and the Third Millennium,
W87-03044 5F

INTERNATIONAL DRINKING WATER SUPPLY AND SANITATION DECADE PROGRAM
Water and the Third Millennium,
W87-03044 5F

INTERNATIONAL LAW
Ixtapa Draft Agreement Relating to the Use of Transboundary Groundwaters,
W87-02592 6E

Amoco Cadiz and Limitation of Liability for Oil Spill Pollution: Domestic and International Solutions,
W87-02593 6E

INTERPOLATION
Rational Allocation of Monitoring Stations in a Lake by Means of the Spline Technique,
W87-02598 7A

INTERSTATE WATER RIGHTS
Colorado v. New Mexico II: Judicial Restraint in the Equitable Apportionment of Interstate Waters,
W87-02595 6E

INTERSTITIAL WATER
Arsenic Distributions in Porewaters and Sediments of Puget Sound, Lake Washington, the Washington Coast and Saanich Inlet, B.C.,
W87-03133 5B

Dissolved Organic Matter in Anoxic Pore Waters from Mangrove Lake, Bermuda,
W87-03136 5A

INVERTEBRATES
Leaf Litter Processing and the Associated Invertebrate Fauna in a Tallgrass Prairie Stream,
W87-03097 2H

IODINATION
Prevention and Treatment of Endemic Iodine-Deficiency Goiter by Iodination of a Municipal Water Supply,
W87-02779 5F

IODINE
Prevention and Treatment of Endemic Iodine-Deficiency Goiter by Iodination of a Municipal Water Supply,
W87-02779 5F

IODOMETRIC TITRATION
Two-Method Verification of Hydrogen Peroxide Determinations in Natural Waters,
W87-03050 5A

ION CHROMATOGRAPHY
HPLC Anion Exclusion Method for Fluoride Determinations in Complex Effluents,
W87-03094 5A

ION EXCHANGE
Contaminating Peptides Widely Present in Ion-Exchanged Water, Reagents, Experimental Implements and Natural Sample,
W87-02787 5B

Investigations on the Application of the Ion-Exchanger SRAFION NMRR for the Enrichment and Separation of Uranium and Other Trace Elements from Sea Water, (Untersuchungen uber die Verwendbarkeit des Ionenaustauschers SRAFION NMRR zur Anreicherung und Abtrennung von Uran und anderen Spurenelementen aus dem Meerwasser),
W87-02803 5A

ION EXCHANGE CAPACITY
Ion Exchange Properties of Retorted Rundle Oil Shale,
W87-02707 5B

ION-SELECTIVE ELECTRODE DETECTION
Flow Injection Analysis of Chloride in Tap and Sewage Water Using Ion-Selective Electrode Detection,
W87-02798 5A

ION TRANSPORT
Contrasting Response to Salt Stress of Two Salinity Tolerant Creeping Bentgrass Clones,
W87-03156 5C

Physiogenic and Anthropogenic Controls of Global and Regional Ionic Runoff,
W87-03275 2E

IONS
Nutrient and Trace Metal Fluxes in the Magela Creek System, Northern Australia,
W87-02974 2E

Effects of Seawater on Amino Acids and Mineral Ions Composition in Salicornia brachiata Roxb,
W87-03093 3C

IRON
Environmental Factors Affecting the Acid Neutralization Capacity of Finnish Glacial Till Deposits,
W87-02588 5B

Study on the Modelling of the Behavior of Phosphorus Released from Sediments,
W87-02967 2L

Response to Waterlogging and Differing Sensitivity to Divalent Iron and Manganese in Clones of Dactylis glomerata L. Derived from Well-Drained and Poorly-Drained Soils,
W87-03095 5C

Flame Absorption Spectroscopic Determination of Cadmium, Copper, Iron, Lead, and Zinc in Mussels,
W87-03115 5A

Study of Foamy Thermomineral Water of French Massif Central. I. Oxidation-reduction Potential and Behavior of Iron (Etude des eaux Thermominearales Carbogazeuses du Massif Central Francais. I. Potentiel d'Oxydo-Reduction et Comportement du Fer),
W87-03134 5B

Effect of Oxygen on Release and Uptake of Cobalt, Manganese, Iron and Phosphate at the Sediment-Water Interface,
W87-03143 5B

Micronutrient Tolerance and Accumulation in the Duckweed, Lemna,
W87-03153 5C

IRRADIATION
Effects of Temperature, Salinity, Irradiance and Diurnal Periodicity on Growth and Photosynthesis in the Diatom Nitzschia americana: Light-Saturated Growth,
W87-02807 2L

IRRIGATED CULTURE
Seasonal Growth and Composition and Accumulation of N-P-K in Dryland and Irrigated Pumpkins,
W87-03150 2I

IRRIGATION
Comparison of Steady Infiltration Solutions for Spherical Cavities Under Simple Versus Variable Hydraulic Properties,
W87-02712 2G

Percolation of Water Below an Irrigated Field,
W87-02722 5B

Root Distribution and Water Uptake Patterns of Maize Cultivars Field-Grown under Differential Irrigation,
W87-02817 2I

Recycling Irrigation Runoff on Container Ornamentals,
W87-02956 3F

Ecological Modelling, Monitoring and Implementation in Irrigated Agriculture,
W87-02966 3F

Decision Support System for Local Water Management,
W87-03064 6D

Relationships Between Growth and Measured Weather Factors Among Contrasting Varieties of Lolium, Dactylis and Festuca Species,
W87-03100 2I

Growth and Nutritional Status of Petunia and Tomato Seedlings with Acidified Irrigation Water,
W87-03105 5C

Effect of Woven Plastic Mulch, Herbicides, Grass Sod, and Nitrogen on 'Foch' Grapes Under Irrigation,
W87-03106 3F

Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. I. Soil Moisture, Water Relations, Tree and Fruit Growth,
W87-03110 3F

Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. II. Mineral Composition of Fruit and Leaves, Fruit Disorders, and Fruit Set,
W87-03111 3F

Water Deficit During Panicle Development in Pearl Millet: Yield Compensation by Tillers,
W87-03157 2I

Effect of Deep Tillage and Controlled Traffic on Root Growth, Water-Use Efficiency and Yield of Irrigated Maize and Wheat,
W87-03165 3F

Effect of Subsoiling and Irrigation on Potato Production,
W87-03169 3F

Effects of In-Row and Interrow Subsoiling and Time of Nitrogen Application on Growth, Stomatal Conductance and Yield of Strip-Tilled Corn,
W87-03170 3F

Use of Grouting When Driving Through the Rock Burst Zone in the Dangara Irrigation Tunnel,
W87-03181 8E

IRRIGATION CYCLES
Nursery Irrigation-Syringe System That Monitors Environmental Parameters,
W87-03107 7C

IRRIGATION DESIGN
Distribute Water Effectively,
W87-02760 3F

IRRIGATION EFFECTS
Effect of Irrigation and Nitrogen Fertilizer on the Yield and Protein Content of Soft White Spring Wheat,
W87-02877 3F

Corn Yield Response to Irrigation, Plant Population and Nitrogen in a Cool, Humid Climate,
W87-02878 3F

IRRIGATION EFFECTS

Profile Modification and Irrigation Effects on Yield and Water Use of Wheat,
W87-02920 3F

Corn Irrigation Scheduling in Humid Regions on Sandy Soils with Tillage Pans,
W87-02981 3F

Irrigation Effects on Agronomic Characters of Meadowfoam,
W87-02995 3F

Effect of High Sulfate Irrigation Waters on Soil Salinity and Yields,
W87-02996 3C

Irrigation Interval as a Factor in Sweet Corn Response to Salinity,
W87-03003 3C

Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-03010 2I

IRRIGATION EFFICIENCY

Distribute Water Effectively,
W87-02760 3F

Comparison of Sprinkler and Flood Irrigation for Rice,
W87-03004 3F

Response of Corn to Tillage and Delayed Irrigation,
W87-03007 2I

Soils Influence Irrigation,
W87-03020 2G

IRRIGATION ENGINEERING

Inexpensive System Using Drip-Emitters for Irrigating Small Plots,
W87-02876 3F

Stochastic Approach to the Crop Yield-Irrigation Relationships in Heterogeneous Soils: II. Application to Irrigation Management,
W87-02922 3F

IRRIGATION PRACTICES

Tips on Trickle,
W87-02761 3F

Stochastic Dominance Comparison of Water-Conserving Irrigation Strategies,
W87-02873 3F

Effects of Frequency of Irrigation on Nutrient Uptake of Apple Trees,
W87-02875 3F

Inexpensive System Using Drip-Emitters for Irrigating Small Plots,
W87-02876 3F

Soil Application of a Hydrophilic Conditioner in Relation to Moisture, Irrigation Frequency and Crop Growth,
W87-02881 3F

Polyacrylamide Application in Irrigation Water to Increase Infiltration,
W87-02911 2G

Profile Modification and Irrigation Effects on Yield and Water Use of Wheat,
W87-02920 3F

Stochastic Approach to the Crop Yield-Irrigation Relationships in Heterogeneous Soils: I. Analysis of the Field Spatial Variability,
W87-02921 3F

Stochastic Approach to the Crop Yield-Irrigation Relationships in Heterogeneous Soils: II. Application to Irrigation Management,
W87-02922 3F

Wheat Residue Management Effects on Soil Water Storage and Corn Production,
W87-02924 3F

Corn Irrigation Scheduling in Humid Regions on Sandy Soils with Tillage Pans,
W87-02981 3F

Management of Sorghum Under Limited Irrigation,
W87-02987 3F

Kleingrass Yield and Quality Under Three Irrigation Regimes When Harvested at Anthesis,
W87-02993 3F

Response of Corn to Tillage and Delayed Irrigation,
W87-03007 2I

Changes in Spring Wheat Tillering Patterns in Response to Delayed Irrigation,
W87-03012 2I

Production Function for Cotton with Dated Irrigation Quantities and Qualities,
W87-03189 3F

IRRIGATION PROGRAMS

Stochastic Dominance Comparison of Water-Conserving Irrigation Strategies,
W87-02873 3F

IRRIGATION SCHEDULING

Irrigation Scheduling Effects on Container Media and Canopy Temperatures and Growth of 'Hershey's Red' Azalea,
W87-03103 3F

IRRIGATION WATER

Polyacrylamide Application in Irrigation Water to Increase Infiltration,
W87-02911 2G

Effect of High Sulfate Irrigation Waters on Soil Salinity and Yields,
W87-02996 3C

Production Function for Cotton with Dated Irrigation Quantities and Qualities,
W87-03189 3F

ISOLATION

Genomic Analysis of RNA Viruses Isolated from Water,
W87-02645 5A

Detection of Hepatitis A Virus (HAV) in Drinking Water,
W87-02646 5A

Detection of Hepatitis A Virus in Drinking Water by Enzyme-Immunoassay Using Ultracentrifugation for Virus Concentration,
W87-02647 5A

Recovery of Viruses from Drinking-Water by Means of an In-Line Electropositive Cartridge Filter,
W87-02649 5A

Detection of Enteroviruses: An Assessment of Ten Cell Lines,
W87-02651 5A

Analysis of Tap Water for Viruses: Results of a Survey,
W87-02652 5A

ISOLINES

Water Use Efficiency in Soybean Pubescence Density Isolines-A Calculation Procedure for Estimating Daily Values,
W87-03000 2I

ISOTOPE DILUTION

Determination of Lead, Cadmium and Thallium in Water Samples at ppb and ppt Levels by Isotope Dilution Mass Spectrometry, (Bestimmung von Blei, Cadmium und Thallium in Wasserproben im ppb- und ppt-Bereich durch massenspektrometrische Isotopenverdunnungsanalyse),
W87-02795 5A

ISOTOPE STUDIES

Hydrogen Isotope Study of Large-Scale Meteoric Water Transport in Northern California and Nevada,
W87-02686 2F

Determination of Lead, Cadmium and Thallium in Water Samples at ppb and ppt Levels by Isotope Dilution Mass Spectrometry, (Bestimmung von Blei, Cadmium und Thallium in Wasserproben im ppb- und ppt-Bereich durch massenspektrometrische Isotopenverdunnungsanalyse),
W87-02795 5A

Biogenic Methane Formation in Marine and Freshwater Environments: CO2 Reduction vs. Acetate Fermentation-Isotope Evidence,
W87-03137 5B

ISRAEL

Saline- versus Freshwater Contribution to the Thermal Waters of the Northern Jordan Rift Valley, Israel,
W87-02852 2F

ITALIAN RYEGRASS

Department of Agriculture, Belfast (N. Ireland). Agricultural and Food Chemistry Research Div.
W87-03159 3F

IXTAPA DRAFT AGREEMENT

Ixtapa Draft Agreement Relating to the Use of Transboundary Groundwaters,
W87-02592 6E

JAMAICA

Stemming the Loss of Coastal Wetland Habitats: Jamaica as a Model for Tropical Developing Countries,
W87-03128 2L

JAPAN

Modelling of Industrial Ecological Systems for Evaluation of Health Services,
W87-02979 4C

Legal System and Works for Preservation of the Port, Harbour, and Marine Environment in Japan,
W87-03249 5G

Environmental Conservation in the Port of Maizuru,
W87-03269 5B

JETS

Experiments on Vertical Plane Buoyant Jets in Shallow Water,
W87-02762 8B

Effect of Waves on Buoyant Jets,
W87-02964 5B

JORDAN RIFT VALLEY

Saline- versus Freshwater Contribution to the Thermal Waters of the Northern Jordan Rift Valley, Israel,
W87-02852 2F

JUDICIAL DECISIONS

Abstention: The Crooked Course of Colorado River,
W87-02596 6E

KANSAS CITY

Design and Performance of Skimming Weirs in the Kansas City District,
W87-03247 8A

KARST HYDROLOGY
Hydrological Investigations of Dinaric Karst at the Krcic Catchment and the River Krka Springs (Yugoslavia),
W87-02845 2A

KELLY AIR FORCE BASE
In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-02754 5G

KERATEINE GEL
Selective Preconcentration of Copper from Aqueous Solution by Using Kerateine Gel,
W87-02802 5A

KIEL FJORD
Structuring of Ecological Data Sets by Methods of Correlation and Cluster Analysis,
W87-02597 2L

KIELDER RESERVOIR
Wave Movement and Water-Quality Variations During a Controlled Release from Kielder Reservoir, North Tyne River, U. K.,
W87-02681 2E

KILLARY HARBOR
Zooplankton Fauna of Killary Harbour: The Seasonal Cycle of Abundance,
W87-03054 2L

KINEMATIC FLOW
Kinematic Overland Flow: Generalization of Rose's Approximate Solution,
W87-02841 2E

KINEMATIC WAVE THEORY
Distribution Function Approach to Water Flow in Soil Macropores Based on Kinematic Wave Theory,
W87-02858 2G

KINETICS
Kinetics of Biological Phosphorus Release,
W87-02737 5D

Relationships Among Growth Rate, Cellular Manganese Concentrations and Manganese Transport Kinetics in Estuarine and Oceanic Species of the Diatom Thalassiosira,
W87-02805 2L

Structure, Energetics and Propagation of Rotating Convective Storms. Part I: Energy Exchange with the Mean Flow,
W87-03215 2B

KINGS CREEK
Leaf Litter Processing and the Associated Invertebrate Fauna in a Tallgrass Prairie Stream,
W87-03097 2H

KLEBSIELLA
Phosphorus Uptake by Klebsiella pneumoniae and Acinetobacter calcoaceticus,
W87-02741 5D

KOLYMA
Experience of Using the Turbine-Generator Units of the Kolyma Hydroelectric Station for Idle Discharge of Water,
W87-03177 8C

KOOTENAI RIVER
Operation of Selective Withdrawal Facilities: Libby Dam, Montana,
W87-03227 5C

KOREA
Water Use in Urban Korea,
W87-02617 6D

LA GRANDE COMPLEX
Self-closing Cylindrical Gate Improves Safety at Low Cost,
W87-02693 8C

LAGOONS
Waterford Treatment Plant - A Small Town Lagoon System,
W87-02834 5D

LAKE ACIDIFICATION
Lake Acidification and the Land-Use Hypothesis: A Mid-Post-Glacial Analogue,
W87-02810 2K

LAKE BASINS
Crater Lake, Oregon: A Restricted Basin with Base-of-Slope Aprons of Nonchannelized Turbidites,
W87-03220 2J

LAKE ERIE
Wildland Management on Point Pelee, Rondeau, and Long Point Peninsulas, Lake Erie,
W87-02591 6G

LAKE GREESON
Selective Withdrawal Needs for Lake Greeson Arkansas Intake Structure,
W87-03242 5G

LAKE KASUMIGAURA
Synthesis and Analysis of a Comprehensive Lake Model - With the Evaluation of Diversity of Ecosystems,
W87-02965 2H

Eutrophication Model of Lake Kasumigaura,
W87-02971 2H

LAKE MORPHOLOGY
Budget of Water and Its Constituents for Lake Taupo (New Zealand),
W87-03295 2H

LAKE NASISELKA
Three-dimensional Water-Quality-Transport Model Compared with Field Observations,
W87-02970 2H

LAKE OSTROVO
Mathematical Prediction of Thermal Stratification of Lake Ostrovo (Vegoritis), Greece,
W87-03198 2H

LAKE RESTORATION
Environmental and Water Quality Operational Studies (EWQOS) - Application to Lake Restoration,
W87-03271 5G

LAKE SEDIMENTS
Efficient Method of Applying Aluminum Salts for Sediment Phosphorus Inactivation in Lakes,
W87-02635 5G

Eutrophication Model of Lake Kasumigaura,
W87-02971 2H

Study of Dissolved Oxygen Budgets in Natural and Artificial Lakes,
W87-02976 2H

Arsenic Distributions in Porewaters and Sediments of Puget Sound, Lake Washington, the Washington Coast and Saanich Inlet, B.C.,
W87-03133 5B

Heavy Metal Content in Sediments of Lakes in Southern Bavaria as a Sign of Long-Term Environmental Impact,
W87-03305 5C

Influence of Catastrophic Floods on Water Quality as Recorded in the Sediments of Blagdon Lake, England,
W87-03306 2H

LAKE SUWA
Interactive Algorithm for the Parameter Estimation of Complex Systems and Its Application to an Ecological Modelling of an Actual Japanese Lake,
W87-02600 2H

LAKE TAUPO
Budget of Water and Its Constituents for Lake Taupo (New Zealand),
W87-03295 2H

LAKE YUNOKO
Study of Dissolved Oxygen Budgets in Natural and Artificial Lakes,
W87-02976 2H

LAKES
Determination of Pollution and Eutrophic Conditions of Sapanca Lake (Turkey),
W87-02587 5B

Validation of a Prognosis Based Upon a Eutrophication Model,
W87-02602 5C

Efficient Method of Applying Aluminum Salts for Sediment Phosphorus Inactivation in Lakes,
W87-02635 5G

Lake Acidification and the Land-Use Hypothesis: A Mid-Post-Glacial Analogue,
W87-02810 2K

Travel Cost Model for Lake Recreation: A Comparison of Two Methods for Incorporating Site Quality and Substitution Effects,
W87-02872 6D

Decomposition Studies in Two Central Ontario Lakes Having Surficial pHs of 4.6 and 6.6,
W87-02897 2H

Synthesis and Analysis of a Comprehensive Lake Model - With the Evaluation of Diversity of Ecosystems,
W87-02965 2H

Review of the Role of Bed Deposits in the Phosphate Eutrophication of Lakes and Rivers,
W87-03022 5B

Acid Rain: A Review of the Phenomenon in the EEC and Europe.
W87-03338 5C

LAMINAR FLOW
Stability Criterion of a Laminar Flow,
W87-02868 8B

LAND APPLICATION
Impact of Chemically Contaminated Sewage Sludge on the Collard Arthropod Community,
W87-03081 5C

LAND DISPOSAL
Correlation of Metal-Organic Fractions with Soil Properties in Sewage-Sludge-Amended Soils,
W87-02714 5E

Nitrilotriacetic Acid in Sludge-amended Soil: Mobility and Effects on Metal Solubility,
W87-02765 5E

Model Simulation of Solute Leaching and Its Application for Estimating the Net Rate of Nitrate Formation under Field Conditions,
W87-02839 5B

Wastewater Engineering Design for Unsewered Areas,
W87-03339 5E

LAND RECLAMATION
Lime-Cement Hardening of Very Soft Freshwater Clay,
W87-03260 8D

LAND TREATMENT
Wastewater Engineering Design for Unsewered Areas,
W87-03339 5E

LAND USE
Lake Acidification and the Land-Use Hypothesis: A Mid-Post-Glacial Analogue,
W87-02810 2K

Soil Potential Ratings for Onsite Wastewater Disposal,
W87-02860 5E

Comparison of Water Quality in Drainage Basins Under Agricultural and Forest Land Use,
W87-03307 2E

LANDFILLS
Unsaturated Flow Through Solid Waste Landfills: Model and Sensitivity Analysis,
W87-02628 5B

Containing Landfill Leaks,
W87-02639 5B

LANGMUIR CIRCULATION
Interaction Between Motile Phytoplankton and Langmuir Circulation,
W87-02969 2L

LARVAE
Acute and Chronic Toxicity of Nickel to Larvae of Chironomus riparis (Meigen),
W87-03083 5C

LATEX
Latex Admixtures for Portland Cement Concrete and Mortar,
W87-03318 8G

LAUNDRY WASTEWATER
Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial Wastewater Reuse and Priority Pollutant Removal,
W87-02753 5D

LAURENTIAN TROUGH
Early Diagenesis of Cadmium and Cobalt in Sediments of the Laurentian Trough,
W87-03138 5B

LEACHATE
Ion Exchange Properties of Retorted Rundle Oil Shale,
W87-02707 5B

LEACHING
Environmental Factors Affecting the Acid Neutralization Capacity of Finnish Glacial Till Deposits,
W87-02588 5B

Model Simulation of Solute Leaching and Its Application for Estimating the Net Rate of Nitrate Formation under Field Conditions,
W87-02839 5B

Modeling Leachate Production from Municipal Landfills,
W87-02883 5B

Rates of Mineral Element Leaching from Leaves of Nine Plant Species from a Southern Appalachian Forest Succession Subjected to Simulated Acid Rain,
W87-03206 5C

LEAD
Chione (Austrovenus) stutchburyi, a New Zealand Cockle, as a Bio-indicator for Lead Pollution,
W87-02586 5A

Lead Dissolution From Soldered Joints,
W87-02607 5B

Possibilities of Improving the Determination of Extremely Low Lead Concentrations in Marine Fish by Graphite Furnace Atomic Absorption Spectrometry,
W87-02794 5A

Determination of Lead, Cadmium and Thallium in Water Samples at ppb and ppt Levels by Isotope Dilution Mass Spectrometry, (Bestimmung von Blei, Cadmium und Thallium in Wasserproben im ppb- und ppt-Bereich durch massenspektrometrische Isotopenverdunnungsanalyse),
W87-02795 5A

Interlaboratory Comparison of Analyses for Heavy Metals in Clam Tissue,
W87-03114 5A

Flame Absorption Spectroscopic Determination of Cadmium, Copper, Iron, Lead, and Zinc in Mussels,
W87-03115 5A

Benthic Fluxes of Cadmium, Copper, Nickel, Zinc and Lead in the Coastal Environment,
W87-03144 5B

Determination of Organically-associated Trace Metals in Estuarine Sea-Water by Solvent Extraction and Atomic-Absorption Spectrometry,
W87-03173 5A

LEAF GAS EXCHANGE
Effect of Short-term Water Stress on Leaf Gas Exchange Processes and Plant Water Potential in Schefflera,
W87-03104 2I

LEAF LITTER
Leaf Litter Processing and the Associated Invertebrate Fauna in a Tallgrass Prairie Stream,
W87-03097 2H

LEAKAGE
Performance of China's First Concrete Cut-off Wall,
W87-02689 8A

Under EPA Scrutiny: Underground Storage Tanks,
W87-03021 5B

LEASES
Distribution of Economic Rents Arising from Subsidized Water When Land is Leased,
W87-02874 6C

LEAVES
Red Alder Leaf Litter and Streamwater Quality in Western Oregon,
W87-02631 5B

Salt Tolerance in the Triticeae: Salinity-Induced Changes in the Leaf Solute Composition of Some Perennial Triticeae,
W87-02785 2I

Rate of Water Loss from Detached Leaves of Drought Resistant and Susceptible Genotypes of Cowpea,
W87-02960 2I

LEGAL ASPECTS
Small Hydroelectric Plants and Environemental Protection, (Petite Hydraulique et Protection de l'Environment),
W87-02573 8C

Coastal Flood Insurance,
W87-02782 6F

Voter Reactions to the 1976 Water Development and Quality Referenda in Texas,
W87-02944 6E

Legal System and Works for Preservation of the Port, Harbour, and Marine Environment in Japan,
W87-03249 5G

LETTUCE
Response of Lettuce Cultivars to Sludge-Amended Soils and Bed Types,
W87-02880 3C

Responses of Lettuce to Salinity. I. Effects of NaCl and Na2SO4 on Growth,
W87-03154 5C

Salt Responses of Lettuce to Salinity. II. Effect of Calcium on Growth and Mineral Status,
W87-03155 5C

LIABILITY
Amoco Cadiz and Limitation of Liability for Oil Spill Pollution: Domestic and International Solutions,
W87-02593 6E

LIAPUNOV FUNCTION
Computation of Hydraulic Transients in Complex Hydro Schemes,
W87-03036 8A

LIBBY DAM
Operation of Selective Withdrawal Facilities: Libby Dam, Montana,
W87-03227 5C

LIFT STATION DESIGN
Sizing Submersible Pumps,
W87-02927 8C

LIGHT
Effects of Light on Growth, RuBPCase Activity and Chemical Composition of Ulva Species (Chlorophyta),
W87-02809 2L

LIGHT ENERGY
Effects of Current Velocity and Light Energy on the Structure of Periphyton Assemblages in Laboratory Streams,
W87-02808 2H

LIGHT INTENSITY
Underwater Light Climate and the Growth and Pigmentation of Planktonic Blue-Green Algae (Cyanobacteria) I. The Influence of light quantity,
W87-02908 2H

Underwater Light Climate and the Growth and Pigmentation of Planktonic Blue-green Algae (Cyanobacteria) II. the Influence of Light Quality,
W87-02909 2H

Chromatic Regulation of Photosystem Composition in the Photosynthetic System of Red and Blue-Green Algae,
W87-03212 2H

LIGHT INTERCEPTION
Dryland Grain Sorghum Water Use, Light Interception, and Growth Response to Planting Geometry,
W87-03008 2I

LIME
Lime-Cement Hardening of Very Soft Freshwater Clay,
W87-03260 8D

LIMNOLOGY
Environmental Gradients in Northwest Freshwater Wetlands,
W87-02615 2H

Classification of Macrophytes in Bodies of Water and of Aquatic Vegetation,
W87-02772 2H

Synthesis and Analysis of a Comprehensive Lake Model - With the Evaluation of Diversity of Ecosystems,
W87-02965 2H

Three-dimensional Water-Quality-Transport Model Compared with Field Observations,
W87-02970 2H

Box Model for Prediction of Water Quality in Eutrophic Lakes,
W87-02972 2H

Study of Dissolved Oxygen Budgets in Natural and Artificial Lakes,
W87-02976 2H

Association Between Some Planktonic Species and Physicochemical Characteristics of the Water of Loktak Lake, Manipur, India,
W87-03025 2H

Mathematical Prediction of Thermal Stratification of Lake Ostrovo (Vegoritis), Greece,
W87-03198 2H

Primary Productivity (C14) at Twin Lakes Colorado: 1973-81 Study Results,
W87-03326 2H

LININGS
Innovative Lagoon Liner Pays Off,
W87-03078 5D

LIPIDS
Acyclic Archaebacterial Ether Lipids in Swamp Sediments,
W87-03141 5A

LIQUID-LIQUID EXTRACTION
Indirect Atomic Absorption Determination of Anionic Surfactants in Wastewaters by Flow Injection Continuous Liquid-Liquid Extraction,
W87-03048 5A

LITERATURE REVIEW
Feasibility of Using Mycorrhizal Fungi for Enhancement of Plant Establishment on Dredged Material Disposal Sites: A Literature Review,
W87-03316 3D

LITERATURE REVIEWS
Environmental Impact of Oil Spills and the Oil Industry Response,
W87-02829 5C

Asbestos in Potable Water Supplies and Attributable Risk of Gastrointestinal Cancer,
W87-02830 5C

Physiological Innocuity of Asbestos in Water,
W87-02831 5C

Fundamentals of Anaerobic Digestion of Wastewater Sludges,
W87-02884 5D

LOAD DISTRIBUTION
Snow Loads in the 1985 National Building Code of Canada: Curved Roofs,
W87-02667 2C

LOCAL GOVERNMENTS
National Water Policy -- Does Anybody Want One,
W87-02619 6E

LOCKS
Lock and Dam 1, Red River Waterway: Hydraulic Model Investigation,
W87-03333 8B

LOKTAK LAKE
Association Between Some Planktonic Species and Physicochemical Characteristics of the Water of Loktak Lake, Manipur, India,
W87-03025 2H

LONDON
Principles and Practices for the Ocean Disposal of Dredged Material: The London Dumping Convention Re-Examined,
W87-03267 5E

LONG ISLAND SOUND
Statistical Technique for Analysis of Environmental Data Containing Periodic Variance Components,
W87-02599 7C

LONG-TERM PLANNING
Comparison of Various Methods of Controlling the Long-Term Operating Regimes of Hydroelectric Stations,
W87-03176 8C

LONG-TERM PREDICTION
Box Model for Prediction of Water Quality in Eutrophic Lakes,
W87-02972 2H

LOST CREEK DAM
Hydraulic Design of the Selective Withdrawal Structures of the Lost Creek Dam,
W87-03223 8A

LOTIC ENVIRONMENT
Effects of Current Velocity and Light Energy on the Structure of Periphyton Assemblages in Laboratory Streams,
W87-02808 2H

LOUISIANA
Radionuclide Concentrations in Louisiana Soils and Sediments,
W87-03085 5B

LOW ALKALINITY WATER
Effects of Corrosion Control of Low Alkalinity Waters - Norwegian Experiences,
W87-03045 5F

MACHINE DATA
Tunnels: Machine Excavation - Rate of Progress - Machine Data,
W87-03320 8A

MACROPHYTES
Classification of Macrophytes in Bodies of Water and of Aquatic Vegetation,
W87-02772 2H

Macrophyte Growth in Shallow Streams: Field Investigations,
W87-02887 5C

Macrophyte Growth in Shallow Streams: Biomass Model,
W87-02888 5C

MACROPOROSITY
Estimating Macroporosity in a Forest Watershed by use of a Tension Infiltrometer,
W87-02917 2G

MAGELA CREEK
Nutrient and Trace Metal Fluxes in the Magela Creek System, Northern Australia,
W87-02974 2E

MAGIC
Modelling the Effects of Acidic Deposition And Conifer Afforestation on Stream Acidity in the British Uplands,
W87-03068 5C

MAGNESIUM
Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. II. Mineral Composition of Fruit and Leaves, Fruit Disorders, and Fruit Set,
W87-03111 3F

MAINTENANCE
Waterline Problems can be Avoided with Care and Testing,
W87-02904 8A

MAIZURU CITY
Environmental Conservation in the Port of Maizuru,
W87-03269 5B

MANAGANESE
Determination of Organically-associated Trace Metals in Estuarine Sea-Water by Solvent Extraction and Atomic-Absorption Spectrometry,
W87-03173 5A

MANAGANESE SPECIATION
Speciation of Manganese in Freshwaters,
W87-03051 2K

MANAGEMENT PLANNING
Estimation of Wastewater Treatment Costs: Evaluation of the CAPDET Model for Canadian Conditions,
W87-02670 5D

Wheat Residue Management Effects on Soil Water Storage and Corn Production,
W87-02924 3F

Complexity in Columbia River Systems Modeling,
W87-03059 6B

Comparison of Various Methods of Controlling the Long-Term Operating Regimes of Hydroelectric Stations,
W87-03176 8C

Effects of Hydraulic Projects and Their Management on Water Quality,
W87-03297 6G

Plan for Protecting Illinois Groundwater.
W87-03331 6B

MANGANESE
Relationships Among Growth Rate, Cellular Manganese Concentrations and Manganese Transport Kinetics in Estuarine and Oceanic Species of the Diatom Thalassiosira,
W87-02805 2L

Response to Waterlogging and Differing Sensitivity to Divalent Iron and Manganese in Clones of Dactylis glomerata L. Derived from Well-Drained and Poorly-Drained Soils,
W87-03095 5C

Effect of Oxygen on Release and Uptake of Cobalt, Manganese, Iron and Phosphate at the Sediment-Water Interface,
W87-03143 5B

Micronutrient Tolerance and Accumulation in the Duckweed, Lemna,
W87-03153 5C

MANNINGS EQUATION
Direct Solutions for Normal Depth Using the Manning Equation,
W87-02963 2E

MANURE
Manurial Value of Septic-Tank Sludge on Grassland,
W87-03102 5E

MARINE ALGAE
Relationships Among Growth Rate, Cellular Manganese Concentrations and Manganese Transport Kinetics in Estuarine and Oceanic Species of the Diatom Thalassiosira,
W87-02805 2L

MARINE ANIMALS
Possibilities of Improving the Determination of Extremely Low Lead Concentrations in Marine Fish by Graphite Furnace Atomic Absorption Spectrometry,
W87-02794 5A

MARINE BACTERIA
Effect of O2 Concentration on Dark H2 Oxidation in Whole Cells of a Marine Sulfur Photo-

MARINE BACTERIA

synthetic Bacterium (Chromatium sp. Strain Miami PBS 1071),
W87-03211 2L

MARINE ECOSYSTEM
Modelling of the Lower Trophic Levels of a Marine Ecosystem and Its Example of Short-period Variations of Chlorophyll and Nutrient in Harima-Nada,
W87-02601 2L

MARINE ENVIRONMENT
Biogenic Methane Formation in Marine and Freshwater Environments: CO2 Reduction vs. Acetate Fermentation-Isotope Evidence,
W87-03137 5B

Management of Bottom Sediments Containing Toxic Substances.
W87-03248 5G

Legal System and Works for Preservation of the Port, Harbour, and Marine Environment in Japan,
W87-03249 5G

Influence of Accumulating Organic Sediment on the Marine Environment in Osaka Bay,
W87-03257 5C

MARINE SEDIMENTS
Arsenic Distributions in Porewaters and Sediments of Puget Sound, Lake Washington, the Washington Coast and Saanich Inlet, B.C.,
W87-03133 5B

Early Diagenesis of Cadmium and Cobalt in Sediments of the Laurentian Trough,
W87-03138 5B

MARK TWAIN LAKE
Seasonal Sediment Yield to Mark Twain Lake, Missouri,
W87-02789 2J

MARSH PLANTS
Alcohol Dehydrogenase Activity in the Roots of Marsh Plants in Naturally Waterlogged Soils,
W87-02816 2I

Characterization and Classification of Seaside-Salt-marsh Soils on Virginia's Eastern Shore,
W87-02919 2L

MARSHES
Atmospheric Methane Sources: Alaskan Tundra Bogs, an Alpine Fen, and a Subarctic Boreal Marsh,
W87-02719 5B

MARYLAND
Maryland's Phosphate Ban-History and Early Results,
W87-02819 5G

Pump Station Gets Navy Discharge and New Life as Civilian,
W87-02925 5F

Basin Water Monitoring: Hydrologic Impact or Legal Compliance,
W87-02940 6E

MASS SPECTROMETRY
Determination of Lead, Cadmium and Thallium in Water Samples at ppb and ppt Levels by Isotope Dilution Mass Spectrometry, (Bestimmung von Blei, Cadmium und Thallium in Wasserproben im ppb- und ppt-Bereich durch massenspektrometrische Isotopenverdunnungsanalyse),
W87-02795 5A

MASSIF DES MAURES
Chemical Erosion Measurements in the Massif des Maures: The Example of the Rimbaud Drainage Basin (Var, France)(Mesures de l'Erosion Chimique dans le Massif des Maures: l'Exemple du Basin Versant du Rimbaud (Var, France)),
W87-03294 2K

MATERIALS ENGINEERING
Designing for Flow,
W87-03125 8A

MATERIALS TESTING
Waterline Problems can be Avoided with Care and Testing,
W87-02904 8A

MATHEMATICAL ANALYSIS
Mathematical Modelling for Multi-Aquifer Groundwater Basins,
W87-02848 2F

Analysis of Methods of Determining the Compressive Strength of Rocks,
W87-03180 8E

Dimensionless Analysis of Optimum Designs,
W87-03185 8A

Hydrologic Similarity: 1. Derivation of the Dimensionless Flood Frequency Curve,
W87-03194 2E

Mathematical Prediction of Thermal Stratification of Lake Ostrovo (Vegoritis), Greece,
W87-03198 2H

Computation of Wave Transmission Over a Shore Protecting Submerged Breakwater,
W87-03217 8B

Spectral and Statistical Characteristics of Shallow Water Waves,
W87-03218 8B

Operational Tools: Selective Withdrawal and Daily Operational Strategy,
W87-03238 5G

MATHEMATICAL EQUATIONS
Taking Hydrology and Economic Factors into Account for Calculating the Economic Diameter of the Penstocks for High Head Micropower Plants, (Prise en Compte de l'Hydrologie et des Facteurs Economiques dans le Calcul du Diametre Economique des Conduites Forcees des Microcentrales Haute Chute),
W87-02568 8C

Direct Solutions for Normal Depth Using the Manning Equation,
W87-02963 2E

Analytical and Numerical Solution of Saint-Venant Equations,
W87-03067 2E

New Formula for the Analytical Solution of the Radial Dispersion Problem,
W87-03199 2F

MATHEMATICAL MODELING
Stochastic Approach to the Crop Yield-Irrigation Relationships in Heterogeneous Soils: I. Analysis of the Field Spatial Variability,
W87-02921 3F

MATHEMATICAL MODELS
Analysis of Transient Phenomena in Hydroelectric Generation Plants, (Calcul des Transitoires dans les Installations Hydrauliques de Production d'Energie),
W87-02580 8C

Delay of Reaction Turbines and Pumps to Transient States, (Retard des Turbines a Reaction et des Pompes dans Leur Comportement en Regime Transitoire),
W87-02581 8C

Impacts of Water Quality Improvement on Site Visitation: A Probabilistic Modeling Approach,
W87-02622 4D

Unsaturated Flow Through Solid Waste Landfills: Model and Sensitivity Analysis,
W87-02628 5B

Comparison of MOBED and HEC-6 River Flow Models,
W87-02669 2E

Modelling the Effects of Hydrological Changes on Stream Water Acidity,
W87-02684 2E

Immiscible Contaminant Transport in Soils and Groundwater with an Emphasis on Petroleum Hydrocarbons: System of Differential Equations vs Single Cell Model,
W87-02729 5B

Modeling of Pollutant Dispersion in Stratified Oscillatory Flows,
W87-02885 5B

Efficient Response Matrix Method for Coupling a Groundwater Simulator and a Regional Agricultural Management Model,
W87-02936 4B

Synthesis and Analysis of a Comprehensive Lake Model - With the Evaluation of Diversity of Ecosystems,
W87-02965 2H

Study on the Modelling of the Behavior of Phosphorus Released from Sediments,
W87-02967 2L

Interaction Between Motile Phytoplankton and Langmuir Circulation,
W87-02969 2L

Eutrophication Model of Lake Kasumigaura,
W87-02971 2H

Assessment of the Impact of Eutrophication Control Measures on South African Impoundments,
W87-02973 5G

Review of the Role of Bed Deposits in the Phosphate Eutrophication of Lakes and Rivers,
W87-03022 5B

SELECT: The Numerical Model,
W87-03235 5G

Numerical Prediction on the Effect of Phosphorus Release Control by Sediment Dredging,
W87-03253 5B

MATHEMATICAL STUDIES
Influence of the Runner Blade Angle Variation on Kaplan Turbine Transients, (Influence de la Variation d'Inclinaison des Pales sur les Regimes Transitoires des Turbines Kaplan),
W87-02579 8C

Seasonal Sediment Yield to Mark Twain Lake, Missouri,
W87-02789 2J

Aquifer Transmissivity of Porous Media from Resistivity Data,
W87-02837 7B

Kinematic Overland Flow: Generalization of Rose's Approximate Solution,
W87-02841 2E

Analysis of Stochastic Groundwater Problems. Part I: Deterministic Partial Differential Equations in Groundwater Flow. A Functional-Analytic Approach,
W87-02842 2F

Analysis of Stochastic Groundwater Flow Problems. Part II: Stochastic Partial Differential

Equations in Groundwater Flow. A Functional-Analytic Approach,
W87-02843 2F

Analysis of Stochastic Groundwater Flow Problems. Part III: Approximate Solution of Stochastic Partial Differential Equations,
W87-02844 2F

Explicit Solution of the Modified Horton Equation,
W87-02850 2G

Simple Approximation for a Moving Interface in a Coastal Aquifer,
W87-02851 2F

Algorithm for Computing the Relationship between Diffusivity and Soil Moisture Content from the Hot Air Method,
W87-02856 2G

Distribution Function Approach to Water Flow in Soil Macropores Based on Kinematic Wave Theory,
W87-02858 2G

Stability Criterion of a Laminar Flow,
W87-02868 8B

Graphic Plotting of the Relationships of Physical Characteristics of Soils,
W87-02871 8D

Temperature Dependence of Soil Water Retention Curves,
W87-02914 2G

Extreme Value Theory Based on the r Largest Annual Events,
W87-03069 2L

Numerical Simulation Relating Land Uses Within a Drainage Basin to the Downstream River Water Quality (Simulation Numerique de l'Influence des Pratiques Culturales dans un BAsin Versant sur la Qualite des Eaux a Son Exutoire),
W87-03300 6G

MATILIJA DAM
Alkali-Silica Reactivity in Five Dams in Southwestern United States,
W87-03319 8F

MATRIX MODIFICATION
Direct Determination of Cd, Cu and Ni in the Elbe River Estuary with Zeeman AAS and Matrix Modification (Direktbestimmung von Cd, Cu and Ni im Elbeastuar mit Hilfe der Zeeman-Atomabsorptionsspektroskopie und Matrixmodifikation),
W87-03087 5A

MATURE GROWTH STAGE
Estimation of Spring Wheat Spike Water Concentration and Grain Maturity from Air Temperature,
W87-02998 2I

MEADOWFOAM
Irrigation Effects on Agronomic Characters of Meadowfoam,
W87-02995 3F

MEANDERS
Plains Cottonwood Recruitment and Survival on a Prairie Meandering River Floodplain, Milk River, Southern Alberta and Northern Montana,
W87-02769 2I

MEASUREMENT
Air Encapsulation: I. Measurement in a Field Soil,
W87-02915 2G

MEASURING INSTRUMENTS
Soil-Water Determination Using Fiber Optics,
W87-02723 2G

Measurements of pH versus Drop Size in Natural Rain,
W87-02811 2B

$5.00; 1-Minute Effluent Quality Tester,
W87-02814 7B

Techniques for Water-Use Measurements of Crop Plants,
W87-02949 7B

Techniques for Measuring Plant Water,
W87-02950 7B

Evaporation Data from a Capillary Evaporimeter,
W87-03073 7B

Controlling Suspended Sediment Samplers by Programmable Calculator and Interface Circuitry,
W87-03337 7B

MEMBRANE FILTRATION
Membrane Filtration Enumeration of Faecal Clostridia and Clostridium Perfringens in Water,
W87-02701 5A

MEMBRANE POTENTIAL
Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: II. K(+) Strongly Promotes Development of Membrane Potential in Vesicles from Cotton Roots,
W87-02718 2I

MERCURY
Control of the Methylation Process in a Mercury-polluted Aquatic Sediment,
W87-02584 5B

MEROMICTIC LAKES
Vertical Diffusion in Meromictic Powell Lake, British Columbia,
W87-02780 2H

METABOLISM
Role of Bacterial Phosphate Metabolism in Enhanced Phosphorus Removal from the Activated Sludge Process,
W87-02743 5D

METAL ORGANIC FRACTIONS
Correlation of Metal-Organic Fractions with Soil Properties in Sewage-Sludge-Amended Soils,
W87-02714 5E

METALS
More Awareness Sought Concerning Role of Metals in Pollution,
W87-02791 5B

METEORIC WATER
Hydrogen Isotope Study of Large-Scale Meteoric Water Transport in Northern California and Nevada,
W87-02686 2F

METEOROLOGY
Possible Role of Symmetric Instability in the Formation of Precipitation Bands,
W87-03213 2B

METHANE
Effects of Chloroform Toxicity on Methane Fermentation,
W87-02704 5D

Atmospheric Methane Sources: Alaskan Tundra Bogs, an Alpine Fen, and a Subarctic Boreal Marsh,
W87-02719 5B

Biogenic Methane Formation in Marine and Freshwater Environments: CO2 Reduction vs. Acetate Fermentation-Isotope Evidence,
W87-03137 5B

METHANOGENESIS
Effects of Cyanide on the Methanogenic Degradation of Phenolic Compounds,
W87-02709 5D

METHANOL
Biodegradation of Methanol and Tertiary Butyl Alcohol in Subsurface Systems,
W87-02732 5B

METHYLATION
Control of the Methylation Process in a Mercury-polluted Aquatic Sediment,
W87-02584 5B

METHYLMERCURY
Control of the Methylation Process in a Mercury-polluted Aquatic Sediment,
W87-02584 5B

MICHIGAN
Trihalomethane Levels in Chlorinated Michigan Drinking Water,
W87-02605 5F

MICROBIAL DEGRADATION
Decomposition Studies in Two Central Ontario Lakes Having Surficial pHs of 4.6 and 6.6,
W87-02897 2H

Mixed-Culture Microbial Protein from Waste Sulfite Pulping Liquor II: Its Production on a Pilot-Plant Scale and Use in Animal Feed,
W87-03132 5E

MICROBIOLOGICAL STUDIES
Waterborne Viral Gastroenteritis,
W87-02612 5C

Importance of the Acidogenic Microflora in Biological Phosphorus Removal,
W87-02749 5D

Sanitary Study of Surface Water and of the Beach of a Water Sports and Leisure Complex,
W87-02777 5B

Growth of Salmonellas in Different Enrichment Media,
W87-02786 5A

R-Plasmid Transfer in Soil and Water,
W87-02792 5C

Microbial Aspects of Wastewater Reuse for Irrigation,
W87-03129 3C

Microbiology of Subsurface Environments.
W87-03325 2F

MICROCLIMATES
Use of Portable Rainout Shelters to Induce Water Stress,
W87-02991 2I

Effects of Carbon Dioxide Enrichment and Soil Water on Maize,
W87-03002 2I

Microclimate of an Upland Grassland,
W87-03101 2I

MICROORGANISMS
Microbial Polymers in the Aquatic Environment-I: Production by Activated Sludge Microorganisms under Different Conditions,
W87-02694 5D

Microbial Polymers in the Aquatic Environment-II: Isolation from Biologically Non-purified and Purified Municipal Waste Water and Analysis,
W87-02695 5D

MICROORGANISMS

Microbial Polymers in the Aquatic Environment-III: Isolation from River, Potable and Underground Water and Analysis,
W87-02696 5B

New Strategies for the Isolation of Microorganisms Responsible for Phosphate Accumulation,
W87-02740 5D

MICROSPRINKLERS
Distribute Water Effectively,
W87-02760 3F

MIDGES
Acute and Chronic Toxicity of Nickel to Larvae of Chironomus riparis (Meigen),
W87-03083 5C

MIGRATION
Geochemical and Environmental Processes Affecting Radionuclide Migration from a Formerly Used Seepage Trench,
W87-03135 5E

MILK RIVER
Plains Cottonwood Recruitment and Survival on a Prairie Meandering River Floodplain, Milk River, Southern Alberta and Northern Montana,
W87-02769 2I

MILL CREEK CHANNEL
Mill Creek Channel, Walla Walla, Washington: Hydraulic Model Investigation,
W87-03335 8B

MILLET
Procedure to Select Drought-Tolerant Sorghum and Millet Genotypes Using Canopy Temperature and Vapor Pressure Deficit,
W87-03001 2I

MINING
Nutrient and Trace Metal Fluxes in the Magela Creek System, Northern Australia,
W87-02974 2E

MINNESOTA
Hydraulic Conductivity and Related Physical Properties of Peat, Lost River Peatland, Northern Minnesota,
W87-02715 2G

Pollutants Associated with Sand and Salt Applied to Roads in Minnesota,
W87-02943 5B

MISSISSIPPI RIVER
Historic Trends in the Sediment Flow Regime of the Mississippi River,
W87-03195 2J

MIXING
Blending in a Single Wet Well,
W87-03236 5G

MIXING COEFFICIENTS
Mixing Coefficient for Ice-covered and Free-surface Flows,
W87-02671 2E

MODEL CALIBRATION
Assuring Accurate Model Calibration,
W87-02610 5F

MODEL STUDIES
Statistical Technique for Analysis of Environmental Data Containing Periodic Variance Components,
W87-02599 7C

Interactive Algorithm for the Parameter Estimation of Complex Systems and Its Application to an Ecological Modelling of an Actual Japanese Lake,
W87-02600 2H

Modeling for Estimating Representative Water Conditions in a River Basin,
W87-02604 5B

Preliminary Model of Long-Term Changes in Stream Acidity in Southwestern Scotland,
W87-02682 5G

Ion Exchange Properties of Retorted Rundle Oil Shale,
W87-02707 5B

Diel Variation of In-stream Nitrification,
W87-02711 5B

Immiscible Contaminant Transport in Soils and Groundwater with an Emphasis on Petroleum Hydrocarbons: System of Differential Equations vs Single Cell Model,
W87-02729 5B

Behaviour of Intracellular Polyphosphate in the Biological Phosphate Removal Process,
W87-02735 5D

Kinetics of Biological Phosphorus Release,
W87-02737 5D

Real-Time Kinematic Catchment Model for Hydro Operation,
W87-02766 2E

Vertical Diffusion in Meromictic Powell Lake, British Columbia,
W87-02780 2H

Single-sludge Nitrogen Removal: Modeling and Experimental Results,
W87-02823 5D

Vertical Transport and Fate of Low-Water-Solubility Chemicals in Unsaturated Soils,
W87-02836 5B

Model Simulation of Solute Leaching and Its Application for Estimating the Net Rate of Nitrate Formation under Field Conditions,
W87-02839 5B

Analysis of Earth-Tide-Induced Groundwater Flow in Eastern Botswana,
W87-02840 2F

Mathematical Modelling for Multi-Aquifer Groundwater Basins,
W87-02848 2F

Determination of Rainfall Excess on Spatially Variable Catchments,
W87-02853 2A

Modified Diffusion Equation for Flood Propagation in Trapezoidal Channels,
W87-02855 2E

Travel Cost Model for Lake Recreation: A Comparison of Two Methods for Incorporating Site Quality and Substitution Effects,
W87-02872 6D

Slack Tide Oxygen Balance Model,
W87-02889 5B

Basin Water Monitoring: Hydrologic Impact or Legal Compliance,
W87-02940 6E

Remote Sensing Techniques for Assessing Water Deficits and Modeling Crop Response,
W87-02953 7B

Climatic Change, Weather Variability, and Corn Production,
W87-03006 2I

Predicting Standard pH Values for Reference Buffer Solutions in Solvent Mixtures with Water,
W87-03049 5A

Financial Planning Model and Its Application,
W87-03058 6B

Evolution of PMP Cooperative Studies,
W87-03063 8A

Comparison of the Coupled Fresh Water-Salt Water Flow and the Ghyben-Herzberg Sharp Interface Approaches to Modeling of Transient Behavior in Coastal Aquifer Systems,
W87-03077 2F

Stemming the Loss of Coastal Wetland Habitats: Jamaica as a Model for Tropical Developing Countries,
W87-03128 2L

Structural Change Implications for Industrial Water Use,
W87-03190 6D

Drains as a Boundary Condition in Finite Elements,
W87-03201 2F

Modeling of Selective Withdrawal Intake Structures,
W87-03230 5G

Model of Nitrogen Release from Bottom Sediments,
W87-03250 5B

Study on Chemical Behavior Between Sediment and Upper Water,
W87-03251 2J

Real Time Water Quality Forecasting Models Based on the Water Quantity/Quality Relationship,
W87-03304 5A

Watershed Modeling for Fire Management Planning in the Northern Rocky Mountains,
W87-03323 4D

MODEL TESTING
Assuring Accurate Model Calibration,
W87-02610 5F

MODEL VALIDATION
Validation of a Prognosis Based Upon a Eutrophication Model,
W87-02602 5C

MODELING
Modeling Leachate Production from Municipal Landfills,
W87-02883 5B

MOISTURE RETENTION
Procedure to Identify Different Groups of Hydraulic-Conductivity and Moisture-Retention Curves for Soil Horizons,
W87-03075 2G

MOISTURE STRESS
Soil Compaction and Moisture Stress Preconditioning in Kentucky Bluegrass. I. Soil Aeration, Water Use, and Root Responses,
W87-02982 2G

Soil Compaction and Moisture Stress Preconditioning in Kentucky Bluegrass. II. Stomatal Resistance, Leaf Water Potential, and Canopy Temperature,
W87-02983 2G

Triadimefon Protects Bean Plants from Water Stress through its Effects on Abscisic Acid,
W87-03202 2I

Accumulation and Turnover of Abscisic Acid in Osmotically Stressed Cotton Leaf Tissue in Relation to Temperature,
W87-03216 2I

MOISTURE TENSION
Observations of Spatial Variability of Soil-Water Pressure in a Field Soil,
W87-02713 2G

MOLDBOARD PLOWING
Physical Environment Near the Surface of Plowed and No-Tilled Soils,
W87-03171 2G

MOLYBDENUM
Micronutrient Tolerance and Accumulation in the Duckweed, Lemna,
W87-03153 5C

Determination of Organically-associated Trace Metals in Estuarine Sea-Water by Solvent Extraction and Atomic-Absorption Spectrometry,
W87-03173 5A

MONITORING
Rational Allocation of Monitoring Stations in a Lake by Means of the Spline Technique,
W87-02598 7A

Detection of Enteroviruses: An Assessment of Ten Cell Lines,
W87-02651 5A

Viruses and Bacteria in a Chalk Well,
W87-02655 5B

Readily Biodegradable Fraction of Sewage: Its Influence on Phosphorus Removal and Measurement,
W87-02738 5D

Concentrations of 20 Volatile Organic Compounds in the Air and Drinking Water of 350 Residents of New Jersey Compared with Concentrations in Their Exhaled Breath,
W87-02774 5B

$5.00, 1-Minute Effluent Quality Tester,
W87-02814 7B

Continuous Monitoring of 222Rn Concentration in Unconfined Groundwater,
W87-02847 5A

Basin Water Monitoring: Hydrologic Impact or Legal Compliance,
W87-02940 6E

Nursery Irrigation-Syringe System That Monitors Environmental Parameters,
W87-03107 7C

Principles Underlying the Development of Water Quality Monitoring Systems in Hungary,
W87-03303 7A

Measuring Suspended Sediment in Small Mountain Streams,
W87-03324 5A

MONTANA
Operation of Selective Withdrawal Facilities: Libby Dam, Montana,
W87-03227 5C

MORPHOLOGICAL THRESHOLDS
Fluvial Processes and Morphological Thresholds in Incised Channel Restoration,
W87-02930 2J

MORTAR
Latex Admixtures for Portland Cement Concrete and Mortar,
W87-03318 8G

MOSQUITOES
Application of Environmental Management Principles in the Program for Eradication of Aedes (Stegomyia) aegypti (Linneus, 1762) in the Republic of Cuba, 1984,
W87-02824 5G

Impacts from Mosquito Control-Induced Sulphur Mobilization in a Cape Cod Estuary,
W87-03127 5C

MOTILITY
Interaction Between Motile Phytoplankton and Langmuir Circulation,
W87-02969 2L

MOUNTAINS
Effects of Variation in Streamside Habitats on the Composition of Mountain Salamander Communities,
W87-03082 2H

MUDFLOWS
Rockfall-Induced Waves in Reservoirs,
W87-03037 8E

MULCH
Evaporation and Redistribution of Salts in a Silt Loam Soil as Affected by Tillage Induced Soil Mulch,
W87-03168 3F

MULCHING
Effect of Tillage and Mulching on Soil Environment and Cowpea Seedling Growth Under Arid Conditions,
W87-03166 3F

MULTIPLE-CRITERIA PROBLEMS
Interactive Algorithm for the Parameter Estimation of Complex Systems and Its Application to an Ecological Modelling of an Actual Japanese Lake,
W87-02600 2H

MULTIVARIATE ANALYSIS
Multivariate Analysis of Quality Parameters to Determine the Chemical Transport in Rivers,
W87-03280 5B

MUNICIPAL LANDFILLS
Modeling Leachate Production from Municipal Landfills,
W87-02883 5B

MUNICIPAL WASTES
Fundamentals of Anaerobic Digestion of Wastewater Sludges,
W87-02884 5D

MUNICIPAL WASTEWATER
Detection of Indigenous Enteric Viruses in Raw Sewage Effluents of the City of Athens, Greece, during a Two Year Survey,
W87-02659 5B

Virus Inactivating Effect of Anaerobic Mesophilic Digestion of Municipal Sludge With or Without Different Preceding Types of Treatment,
W87-02661 5D

Microbial Polymers in the Aquatic Environment-II: Isolation from Biologically Non-purified and Purified Municipal Waste Water and Analysis,
W87-02695 5D

Salmonellae and Pollution Indicator Bacteria in Municipal and Food Processing Effluents and the Cornwallis River,
W87-02815 5D

Adapting Industrial Approaches to Municipal Wastewater Treatment Problems,
W87-02905 5D

MUNICIPAL WATER
Evaluation of Weekly and Monthly Time Series Forecasts of Municipal Water Use,
W87-02629 6A

Prevention and Treatment of Endemic Iodine-Deficiency Goiter by Iodination of a Municipal Water Supply,
W87-02779 5F

Phenotypic Characteristics of Coliform and Noncoliform Bacteria from a Public Water Supply Compared with Regional and National Clinical Species,
W87-02894 5A

MUSKMELONS
Muskmelon Growth, Yield, and Nutrition as Influenced by Planting Method and Trickle Irrigation,
W87-03108 3F

MUSSELS
Flame Absorption Spectroscopic Determination of Cadmium, Copper, Iron, Lead, and Zinc in Mussels,
W87-03115 5A

Mussel Watch Program/Monitoring the Long-Term Effects of Dredged Material Disposal in New England Waters,
W87-03270 5B

MYCORRHIZAE
Feasibility of Using Mycorrhizal Fungi for Enhancement of Plant Establishment on Dredged Material Disposal Sites: A Literature Review,
W87-03316 3D

NASSAU COUNTY
Petroleum Recovery Operations in an Urban Area,
W87-03065 5G

NATIONAL WATER POLICY
National Water Policy – Does Anybody Want One,
W87-02619 6E

NATURAL WATERS
Viable but Nonculturable Stage of Campylobacter jejuni and Its Role in Survival in the Natural Aquatic Environment,
W87-02899 5B

NAVIGATION
Riprap Stability and Navigation Tests for the Divide-Cut Section Tennessee-Tombigbee Waterway,
W87-03317 8A

NEPAL
Small Power Stations Abroad, (Aspects Specifiques de Minicentrales a l'Etranger),
W87-02566 8C

NEVADA
Hydrogen Isotope Study of Large-Scale Meteoric Water Transport in Northern California and Nevada,
W87-02686 2F

NEW ENGLAND
Mussel Watch Program/Monitoring the Long-Term Effects of Dredged Material Disposal in New England Waters,
W87-03270 5B

NEW JERSEY
Control of the Methylation Process in a Mercury-polluted Aquatic Sediment,
W87-02584 5B

Concentrations of 20 Volatile Organic Compounds in the Air and Drinking Water of 350 Residents of New Jersey Compared with Concentrations in Their Exhaled Breath,
W87-02774 5B

Vegetation of the Low-Shrub Bogs of Northern New Jersey and Adjacent New York: Ecosystems at their Southern Limit,
W87-03208 2H

NEW MEXICO
Colorado v. New Mexico II: Judicial Restraint in the Equitable Apportionment of Interstate Waters,
W87-02595 6E

NEW YORK
Toxic Substances, Risk Management and New York State Drinking Water,
W87-02832 5B

Vegetation of the Low-Shrub Bogs of Northern New Jersey and Adjacent New York: Ecosystems at their Southern Limit,
W87-03208 2H

Effectiveness of Capping in Isolating Dutch Kills Sediment from Biota and the Overlying Water,
W87-03332 5G

NEW YORK HARBOR
Characterization of Sediment Contamination Utilizing Bioassay/Bioaccumulation Testing,
W87-03255 5B

NEW ZEALAND
Budget of Water and Its Constituents for Lake Taupo (New Zealand),
W87-03295 2H

NEWFOUNDLAND
Large Pelton Turbines for Canada's Cat Arm Scheme,
W87-02688 8C

NEWTONIAN FLOW
Non-Darcian Transmission of Water in Certain Humified Peats,
W87-02846 2G

NHO RIVER
Purification of Nho River by the Gravel Contact Method,
W87-03266 5G

NICKEL
Acute and Chronic Toxicity of Nickel to Larvae of Chironomus riparis (Meigen),
W87-03083 5C

Direct Determination of Cd, Cu and Ni in the Elbe River Estuary with Zeeman AAS and Matrix Modification (Direktbestimmung von Cd, Cu and Ni im Elbeastuar mit Hilfe der Zeeman-Atomabsorptionsspektroskopie und Matrixmodifikation),
W87-03087 5A

Benthic Fluxes of Cadmium, Copper, Nickel, Zinc and Lead in the Coastal Environment,
W87-03144 5B

Determination of Organically-associated Trace Metals in Estuarine Sea-Water by Solvent Extraction and Atomic-Absorption Spectrometry,
W87-03173 5A

NIDDA RIVER
Dissolved and Suspended Loads of the Regulated River Nidda in the Rhine-Main Area,
W87-03299 5B

NIGERIA
Comparative Analysis of Transmissivity and Hydraulic Conductivity Values from the Ajali Aquifer System of Nigeria,
W87-02859 2F

Soil Water Balance of Intercropped Maize and Cowpea Grown in a Tropical Hydromorphic Soil in Western Nigeria,
W87-02989 2I

Financial Viability and Economic Efficiency of Water Supply in Kwara State - The Case of Ilorin,
W87-03046 5F

Mechanized Tillage Systems Effects on Properties of a Tropical Alfisol in Watersheds Cropped to Maize,
W87-03162 2G

NITRATE
Fertilizers Suitable for the Environment as Part of a Reorientation in Agricultural Policy,
W87-03040 5G

NITRATES
Model Simulation of Solute Leaching and Its Application for Estimating the Net Rate of Nitrate Formation under Field Conditions,
W87-02839 5B

Sources of Nitrate to Ground Water,
W87-03130 5B

Nitrate Load/Discharge Relationships and Nitrate Load Trends in Danish Rivers,
W87-03302 5B

NITRIFICATION
Effect of Seawater on Nitrification by Attached Biofilm,
W87-02603 5D

Diel Variation of In-stream Nitrification,
W87-02711 5B

Nutrient Transformation in Retention/Detention Ponds Receiving Highway Runoff,
W87-02821 5D

Developing Management Guidelines for River Nitrogenous Oxygen Demand,
W87-02822 5G

NITRILOTRIACETIC ACID
Nitrilotriacetic Acid in Sludge-amended Soil: Mobility and Effects on Metal Solubility,
W87-02765 5E

NITRITES
Fluorometric Determination of Nitrite in Natural Waters with 3-Aminonaphthalene-1,5-disulphonic Acid by Flow-Injection Analysis,
W87-03172 5A

NITROGEN
Developing Management Guidelines for River Nitrogenous Oxygen Demand,
W87-02822 5G

Single-sludge Nitrogen Removal: Modeling and Experimental Results,
W87-02823 5D

Effect of Irrigation and Nitrogen Fertilizer on the Yield and Protein Content of Soft White Spring Wheat,
W87-02877 3F

Corn Yield Response to Irrigation, Plant Population and Nitrogen in a Cool, Humid Climate,
W87-02878 3F

Study on the Modelling of the Behavior of Phosphorus Released from Sediments,
W87-02967 2L

Interactive Effects of Nitrogen and Water Stresses on Water Relations of Field-Grown Corn Leaves,
W87-02994 2I

Evaluation of Methods for Preservation of Water Samples for Nutrient Analysis,
W87-03030 5A

Effect of Woven Plastic Mulch, Herbicides, Grass Sod, and Nitrogen on 'Foch' Grapes Under Irrigation,
W87-03106 3F

Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. II. Mineral Composition of Fruit and Leaves, Fruit Disorders, and Fruit Set,
W87-03111 3F

Seasonal Growth and Composition and Accumulation of N-P-K in Dryland and Irrigated Pumpkins,
W87-03150 2I

Model of Nitrogen Release from Bottom Sediments,
W87-03250 5B

NITROGEN-15
Ammonium (15N) Metabolism in Cotton Under Salt Stress,
W87-03151 5C

NITROGEN ACCUMULATION
Forms of Nitrogen in Waterlogged Soils and Their Contribution to Yield and Nitrogen Uptake by Rice,
W87-03158 3C

NITROGEN COMPOUNDS
Temporal Evolution of Nitrogen Compounds in Swedish Precipitation Since 1955,
W87-02812 2B

Field Validation of the Contaminant Transport Model, FEMA,
W87-03089 5B

NITROGEN CYCLE
Effect of Cultivated and Wild Rice Varieties on the Nitrogen Balance of Flooded Soil,
W87-02813 2I

Model Simulation of Solute Leaching and Its Application for Estimating the Net Rate of Nitrate Formation under Field Conditions,
W87-02839 5B

NITROGEN FERTILIZERS
Department of Agriculture, Belfast (N. Ireland). Agricultural and Food Chemistry Research Div.
W87-03159 3F

NITROGEN ISOTOPES
New Procedure for Extraction of Ammonium from Natural Waters for 15N Isotopic Ratio Determinations,
W87-02902 5A

NITROGEN REMOVAL
Exchange of Organics, Phosphate and Cations between Sludge and Water in Biological Phosphorus and Nitrogen Removal Processes,
W87-02745 5D

Importance of the Acidogenic Microflora in Biological Phosphorus Removal,
W87-02749 5D

Biological Phosphorus and Nitrogen Removal at an Experimental Full Scale Plant in the U.K.,
W87-02750 5D

NITROGEN SOURCES
Nitrogen Source and Application Timing for Trickle Irrigated Strawberries,
W87-03109 3F

NITROUS OXIDE
Transport and Loss of Nitrous Oxide in Soil Water After Forest Clear-cutting,
W87-02912 5B

NITZSCHIA
Effects of Temperature, Salinity, Irradiance and Diurnal Periodicity on Growth and Photosynthesis in the Diatom Nitzschia americana: Light-Saturated Growth,
W87-02807 2L

NO-TILLAGE MANAGEMENT
Nonpoint Source Loading of Phenolic Acids from Decomposing Crop Residue,
W87-03161 5B

Mechanized Tillage Systems Effects on Properties of a Tropical Alfisol in Watersheds Cropped to Maize,
W87-03162 2G

Evaporation and Redistribution of Salts in a Silt Loam Soil as Affected by Tillage Induced Soil Mulch,
W87-03168 3F

Physical Environment Near the Surface of Plowed and No-Tilled Soils,
W87-03171 2G

NON-DARCIAN FLOW
Non-Darcian Transmission of Water in Certain Humified Peats,
W87-02846 2G

NON-PARAMETRIC STATISTICS
Structuring of Ecological Data Sets by Methods of Correlation and Cluster Analysis,
W87-02597 2L

NONAQUEOUS SOLVENTS
Predicting Standard pH Values for Reference Buffer Solutions in Solvent Mixtures with Water,
W87-03049 5A

NONPOINT POLLUTION SOURCES
Nonpoint Source Loading of Phenolic Acids from Decomposing Crop Residue,
W87-03161 5B

NORTH AFRICA
Examination of the Mechanisms Controlling Groundwater Gradients in Hyper-Arid Regional Sedimentary Basins,
W87-02942 2F

NORTH CAROLINA
Virginia, North Carolina Wage Water-Rights Battle,
W87-02638 6E

Water and Hygiene: The Case of North Carolina Farmworkers,
W87-02756 6D

NORTH DAKOTA
Burlington Spillway and Outlet Works Souris River, North Dakota: Hydraulic Model Investigation,
W87-03334 8B

NORTHEAST UNITED STATES
Water Supply in the Northeast: A Study in Regulatory Failure,
W87-02590 6E

NORWAY
Levels of Chlorinated Hydrocarbons and Composition of PCB in Herring Gull Larus argentatus Eggs Collected in Norway in 1969 Compared to 1979-81,
W87-02585 5B

Effects of Corrosion Control of Low Alkalinity Waters - Norwegian Experiences,
W87-03045 5F

NUCELLA
Decline of the Gastropod Nucella lapillus Around South-West England: Evidence for the Effect of Tributyltin from Antifouling Paints,
W87-03053 5C

NUCLEIC ACIDS
Genomic Analysis of RNA Viruses Isolated from Water,
W87-02645 5A

NUMERICAL ANALYSIS
Analytical and Numerical Solution of Saint-Venant Equations,
W87-03067 2E

NUMERICAL SIMULATION MODELS
Modelling of Stratified Flow and Eutrophication in Reservoirs,
W87-02968 5C

NURSERIES
Nursery Irrigation-Syringe System That Monitors Environmental Parameters,
W87-03107 7C

NUTRIENT ACCUMULATION
Seasonal Growth and Composition and Accumulation of N-P-K in Dryland and Irrigated Pumpkins,
W87-03150 2I

NUTRIENT ANALYSIS
Evaluation of Methods for Preservation of Water Samples for Nutrient Analysis,
W87-03030 5A

NUTRIENT DYNAMICS
Eutrophication Model of Lake Kasumigaura,
W87-02971 2H

NUTRIENT FLUCTUATIONS
Nutrient and Trace Metal Fluxes in the Magela Creek System, Northern Australia,
W87-02974 2E

NUTRIENT MODELING
Effect of Catchment Size on Phosphorus Export,
W87-02941 5B

NUTRIENT REMOVAL
Behaviour of Intracellular Polyphosphate in the Biological Phosphate Removal Process,
W87-02735 5D

Biological Phosphorus and Nitrogen Removal at an Experimental Full Scale Plant in the U.K.,
W87-02750 5D

NUTRIENTS
Modelling of the Lower Trophic Levels of a Marine Ecosystem and Its Example of Short-period Variations of Chlorophyll and Nutrient in Harima-Nada,
W87-02601 2L

Validation of a Prognosis Based Upon a Eutrophication Model,
W87-02602 5C

Nutrient Transformation in Retention/Detention Ponds Receiving Highway Runoff,
W87-02821 5D

Developing Management Guidelines for River Nitrogenous Oxygen Demand,
W87-02822 5G

Single-sludge Nitrogen Removal: Modeling and Experimental Results,
W87-02823 5D

Effects of Frequency of Irrigation on Nutrient Uptake of Apple Trees,
W87-02875 3F

Synthesis and Analysis of a Comprehensive Lake Model - With the Evaluation of Diversity of Ecosystems,
W87-02965 2H

Study on the Modelling of the Behavior of Phosphorus Released from Sediments,
W87-02967 2L

Study on Chemical Behavior Between Sediment and Upper Water,
W87-03251 2J

Different Techniques for the Computation of River Nutrient Loads (Methodologies de Quantification des Flux de Nutriments en Riviere),
W87-03298 2H

NYSA KLODSKA RIVER
Analytical and Numerical Solution of Saint-Venant Equations,
W87-03067 2E

OAHU
Comparison of the Coupled Fresh Water-Salt Water Flow and the Ghyben-Herzberg Sharp Interface Approaches to Modeling of Transient Behavior in Coastal Aquifer Systems,
W87-03077 2F

OBSERVATION WELLS
Location of an Interface Observation Well: A Bayesian Approach,
W87-03187 2F

OCEAN CURRENTS
Bed Friction and Dissipation in a Combined Current and Wave Motion,
W87-03210 8B

OCEAN DISPOSAL
Principles and Practices for the Ocean Disposal of Dredged Material: The London Dumping Convention Re-Examined,
W87-03267 5E

OCEAN DUMPING
Evaluation of the Factors Governing the Mobility of Dredged Material Placed at Open Water Disposal Sites,
W87-03252 5E

OCEAN WAVES
Recent Advances in the Computation of Nonlinear Wave Effects on Offshore Structures,
W87-02668 8B

ODOR CONTROL
Assessment of Odorous Emissions from Sewage Pumpstations,
W87-03029 5D

ODOR DETECTION
Assessment of Odorous Emissions from Sewage Pumpstations,
W87-03029 5D

ODWHCX MODEL
Vertical-Horizontal Transport and Fate of Low Water Solubility Chemicals in Unsaturated Soils,
W87-03074 2G

OFFSHORE PLATFORMS
Recent Advances in the Computation of Nonlinear Wave Effects on Offshore Structures,
W87-02668 8B

OHAU RIVER
Transport of Gravel by Flows up to 500 cu m/s, Ohau River, Otago, New Zealand,
W87-02773 2J

OHIO
Proceedings of the Ohio Water Law Conference.
W87-03308 6E

Ohio Water Law: The Present,
W87-03310 6E

Ohio Water Law: Analyses of Present Water Protection Strategies and Suggestions for the Future,
W87-03311 6E

State Common Law Water Rights in the Context of the Federal System,
W87-03312 6E

Ohio Water Law: Present Aspects of Ohio Water Policy,
W87-03313 6E

Current State of Ohio's Water Law from a Judicial and Administrative Perspective: Case Studies and Discussion,
W87-03314 6E

Moving Toward a Coordinated Groundwater Management Approach - A Legislative Proposal,
W87-03315 6E

OHIO RIVER
Selective Withdrawal Structure Operation Experiences in ORD,
W87-03243 8A

OIL RECOVERY
Petroleum Recovery Operations in an Urban Area,
W87-03065 5G

OIL SHALE
Ion Exchange Properties of Retorted Rundle Oil Shale,
W87-02707 5B

OIL SPILL
Amoco Cadiz and Limitation of Liability for Oil Spill Pollution: Domestic and International Solutions,
W87-02593 6E

OIL SPILL LIABILITY
Amoco Cadiz and Limitation of Liability for Oil Spill Pollution: Domestic and International Solutions,
W87-02593 6E

OIL SPILLS
Environmental Impact of Oil Spills and the Oil Industry Response,
W87-02829 5C

OILSEED CROPS
Irrigation Effects on Agronomic Characters of Meadowfoam,
W87-02995 3F

OPEN-CHANNEL FLOW
Direct Solutions for Normal Depth Using the Manning Equation,
W87-02963 2E

OPEN CHANNELS
Modified Diffusion Equation for Flood Propagation in Trapezoidal Channels,
W87-02855 2E

OPERATING POLICIES
Operator's Guide to Protozoa and their Role in the Activated Sludge Process,
W87-02903 5D

OPOSSUM SHRIMP
Synthesis and Analysis of a Comprehensive Lake Model - With the Evaluation of Diversity of Ecosystems,
W87-02965 2H

OPTIMIZATION
Economy and Performance of Small Turbines, (Economie et Performance des Petites Turbines),
W87-02570 8C

Factors Affecting Biological Removal of Phosphorus,
W87-02748 5D

OPTIMUM DEVELOPMENT PLANS
Minimizing the Cost of Coping with Droughts: Springfield, Illinois,
W87-03057 6D

ORCHARDS
Spatial Variability and Soil Sampling for Salinity and Sodicity Appraisal in Surface Irrigated Orchards,
W87-02726 2G

Distribute Water Effectively,
W87-02760 3F

Trickle Irrigation System for Recycling Residential Wastewater on Fruit Trees,
W87-02955 3C

OREGON
Red Alder Leaf Litter and Streamwater Quality in Western Oregon,
W87-02631 5B

Crater Lake, Oregon: A Restricted Basin with Base-of-Slope Aprons of Nonchannelized Turbidites,
W87-03220 2J

Reservoir Regulation and Selective Withdrawal in Oregon,
W87-03226 6D

ORES
Hydrometallurgy: Winning Metals with Water,
W87-02618 5G

ORGANIC ACID ANALYSIS
HPLC Anion Exclusion Method for Fluoride Determinations in Complex Effluents,
W87-03094 5A

ORGANIC CARBON
Physical Environment Near the Surface of Plowed and No-Tilled Soils,
W87-03171 2G

ORGANIC COMPOUNDS
Sorption of Hydrophobic Trace Organic Compounds in Groundwater Systems,
W87-02730 5B

Exchange of Organics, Phosphate and Cations between Sludge and Water in Biological Phosphorus and Nitrogen Removal Processes,
W87-02745 5D

Organic and Trace Metal Levels in Ocean Quahog, Arctica islandica Linne, from the Northwestern Atlantic,
W87-02759 5B

Concentrations of 20 Volatile Organic Compounds in the Air and Drinking Water of 350 Residents of New Jersey Compared with Concentrations in Their Exhaled Breath,
W87-02774 5B

Groundwater Contamination with Synthetic Organic Compounds and Pesticides in Suffolk County,
W87-02827 5B

Toxic Substances, Risk Management and New York State Drinking Water,
W87-02832 5B

Influence of Accumulating Organic Sediment on the Marine Environment in Osaka Bay,
W87-03257 5C

ORGANIC MATTER
Nature of Particulate Organic Matter in the River Indus, Pakistan,
W87-03148 5A

ORGANIC SOLVENTS
Prediction of the Distribution Constant of some Solutes Containing Hydrophilic Functional Groups from Data on the Solubility of Water in Organic Solvents,
W87-02906 1B

ORGANIC WATER
Organic Water: Isotopic Characterization and Evidence for Its Role in the Fedj-el-Adoum Pb-Zn Deposit, Tunisia (Eau organique: caracterisation isotopique et evidence de son role dans le gisement Pb-Zn de Fedj-el-Adoum, Tunisie),
W87-03090 5B

ORGANOCHLORINE PESTICIDES
Insecticides and Metals in Nigerian Surface Water - Warri River,
W87-03028 5B

ORGANOPHOSPHATE COMPOUNDS
Absence of Acclimation to Parathion by Rainbow Trout During Sublethal Exposure,
W87-02697 5C

ORGANOTIN COMPOUNDS
Effect of Organotins on Fecal Pollution Indicator Organisms,
W87-02901 5C

Decline of the Gastropod Nucella lapillus Around South-West England: Evidence for the Effect of Tributyltin from Antifouling Paints,
W87-03053 5C

ORGANOTINS
Ecological Evaluation of Organotin-Contaminated Sediment,
W87-03254 5B

ORNAMENTALS
Recycling Irrigation Runoff on Container Ornamentals,
W87-02956 3F

Water Conservation and Recycling in Ornamentals Production,
W87-02957 3F

Interactive Effects of Sewage Effluent Irrigation and Supplemental Fertilization on Container-Grown Trees,
W87-02958 3C

ORTHANILIC ACID
Orthanilic Acid and Analogues as Carbon Sources for Bacteria: Growth Physiology and Enzymic Desulphonation,
W87-02781 5D

OSAKA BAY
Basin-wide Ecological Fate Model for Management of Chemicals Hazard,
W87-02975 5B

Influence of Accumulating Organic Sediment on the Marine Environment in Osaka Bay,
W87-03257 5C

Results of Sedimentation and Elutriate Tests from Osaka Bay Sediment,
W87-03258 2J

OSCILLATORY FLOW
Modeling of Pollutant Dispersion in Stratified Oscillatory Flows,
W87-02885 5B

OSMOSIS
Methods of Inducing Water Stress in Plants,
W87-02951 2I

OSMOTIC PRESSURE
Accumulation and Turnover of Abscisic Acid in Osmotically Stressed Cotton Leaf Tissue in Relation to Temperature,
W87-03216 2I

OUTFALL SEWERS
Effect of Waves on Buoyant Jets,
W87-02964 5B

OUTLETS
Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures.
W87-03221 8A

Water Quality Outlet Warm Springs Dam,
W87-03232 5G

Thoughts and Considerations for Hydraulic Design,
W87-03241 8B

Burlington Spillway and Outlet Works Souris River, North Dakota: Hydraulic Model Investigation,
W87-03334 8B

OUTWASH
Retardation of Toxic Chemicals in a Contaminated Outwash Aquifer,
W87-02731 5B

OVERHEAD IRRIGATION
Irrigation Scheduling Effects on Container Media and Canopy Temperatures and Growth of 'Hershey's Red' Azalea,
W87-03103 3F

OVERLAND FLOW
Kinematic Overland Flow: Generalization of Rose's Approximate Solution,
W87-02841 2E

OVERPRESSURE
Overpressure Peak in Dual Horizontal Francis Turbines: Industrial Experiments Results, (Pic de Surpression des Francis Horizontales Doubles: Resultats d'Experiences Industrielles),
W87-02578 8C

OVERSPEEDING
Overspeeding Processes in Reversible Units of Pumped-Storage Stations,
W87-03179 8C

OXIDATION
Effect of O2 Concentration on Dark H2 Oxidation in Whole Cells of a Marine Sulfur Photosynthetic Bacterium (Chromatium sp. Strain Miami PBS 1071),
W87-03211 2L

OXIDATION PONDS
Behaviour of Coliphages in Oxidation Ponds,
W87-02666 5D

Seawater Induced Algal Flocculation,
W87-02703 5D

OXYGEN
Effect of Oxygen on Release and Uptake of Cobalt, Manganese, Iron and Phosphate at the Sediment-Water Interface,
W87-03143 5B

Effect of O2 Concentration on Dark H2 Oxidation in Whole Cells of a Marine Sulfur Photosynthetic Bacterium (Chromatium sp. Strain Miami PBS 1071),
W87-03211 2L

OXYGEN BALANCE MODELS
Slack Tide Oxygen Balance Model,
W87-02889 5B

OXYGEN DEMAND
Developing Management Guidelines for River Nitrogenous Oxygen Demand,
W87-02822 5G

OYSTER TISSUES
Interlaboratory Comparison of Analyses for Heavy Metals in Clam Tissue,
W87-03114 5A

PAINT CREEK LAKE
Selective Experiences: Alias Withdrawal Pains,
W87-03246 6B

PAINTSVILLE LAKE
Selective Experiences: Alias Withdrawal Pains,
W87-03246 6B

PAKISTAN
Nature of Particulate Organic Matter in the River Indus, Pakistan,
W87-03148 5A

PAN EVAPORATION
Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. II. Mineral Composition of Fruit and Leaves, Fruit Disorders, and Fruit Set,
W87-03111 3F

PARATHION
Absence of Acclimation to Parathion by Rainbow Trout During Sublethal Exposure,
W87-02697 5C

PARIS BASIN
Metabolical Activity of Bacteria in Geothermal Spring-waters Dating from Dogger and Trias Periods in the Bassin Parisien, (Activites Metaboliques des Bacteries des Eaux Geothermales du Dogger et du Trias du Bassin Parisien),
W87-02562 5B

PARKER DAM
Alkali-Silica Reactivity in Five Dams in Southwestern United States,
W87-03319 8F

PARTIAL DIFFERENTIAL EQUATIONS
Analysis of Stochastic Groundwater Problems. Part I: Deterministic Partial Differential Equations in Groundwater Flow. A Functional-Analytic Approach,
W87-02842 2F

Analysis of Stochastic Groundwater Flow Problems. Part II: Stochastic Partial Differential Equations in Groundwater Flow. A Functional-Analytic Approach,
W87-02843 2F

Analysis of Stochastic Groundwater Flow Problems. Part III: Approximate Solution of Stochastic Partial Differential Equations,
W87-02844 2F

PARTICULATE MATTER
Dissolved and Particulate Load in Danish Water Courses,
W87-03293 5B

PATH OF POLLUTANTS
Distribution of Anionic Surfactants in the Water Column of the Gulf of Fos-sur-Mer, (Distribution des Detergents Anioniques dans la Colonne d'Eau du Golfe de Fos-sur-Mer),
W87-02563 5B

Adsorption of Select Phenol Derivatives by Dolomite,
W87-02583 5B

Rational Allocation of Monitoring Stations in a Lake by Means of the Spline Technique,
W87-02598 7A

Modeling for Estimating Representative Water Conditions in a River Basin,
W87-02604 5B

Unsaturated Flow Through Solid Waste Landfills: Model and Sensitivity Analysis,
W87-02628 5B

Examination of the Penetration of Enteric Viruses in Soils under Simulated Conditions in the Laboratory,
W87-02663 5B

Mixing Coefficient for Ice-covered and Free-surface Flows,
W87-02671 2E

Ion Exchange Properties of Retorted Rundle Oil Shale,
W87-02707 5B

Diel Variation of In-stream Nitrification,
W87-02711 5B

Influence of Soil Structure on Movement Rate of Salts Through Soils,
W87-02716 5B

Deposition of Atmospheric Trace Metals in Northern Sweden as Measured in the Snowpack,
W87-02720 5B

Percolation of Water Below an Irrigated Field,
W87-02722 5B

Immiscible Contaminant Transport in Soils and Groundwater with an Emphasis on Petroleum Hydrocarbons: System of Differential Equations vs Single Cell Model,
W87-02729 5B

Sorption of Hydrophobic Trace Organic Compounds in Groundwater Systems,
W87-02730 5B

Retardation of Toxic Chemicals in a Contaminated Outwash Aquifer,
W87-02731 5B

Transport of Solutes in Soil: Basic Features of Front Retardation,
W87-02733 5B

Organic and Trace Metal Levels in Ocean Quahog, Arctica islandica Linne, from the Northwestern Atlantic,
W87-02759 5B

Metal Concentrations in the Annual Shell Layers of the Bivalve Elliptio complanata,
W87-02764 5B

Human Viruses in Sediments, Sludges, and Soils,
W87-02768 5B

Developing Management Guidelines for River Nitrogenous Oxygen Demand,
W87-02822 5G

Vertical Transport and Fate of Low-Water-Solubility Chemicals in Unsaturated Soils,
W87-02836 5B

Model Simulation of Solute Leaching and Its Application for Estimating the Net Rate of Nitrate Formation under Field Conditions,
W87-02839 5B

Effect of Soil and Effluent Characteristics on Phosphorus Sorption in Dosed Columns,
W87-02861 2G

Modeling Leachate Production from Municipal Landfills,
W87-02883 5B

Slack Tide Oxygen Balance Model,
W87-02889 5B

Decomposition Studies in Two Central Ontario Lakes Having Surficial pHs of 4.6 and 6.6,
W87-02897 2H

Viable but Nonculturable Stage of Campylobacter jejuni and Its Role in Survival in the Natural Aquatic Environment,
W87-02899 5B

Fluridone Retention and Release in Soils,
W87-02918 5B

Effect of Catchment Size on Phosphorus Export,
W87-02941 5B

Pollutants Associated with Sand and Salt Applied to Roads in Minnesota,
W87-02943 5B

Effect of Waves on Buoyant Jets,
W87-02964 5B

Study on the Modelling of the Behavior of Phosphorus Released from Sediments,
W87-02967 2L

Nutrient and Trace Metal Fluxes in the Magela Creek System, Northern Australia,
W87-02974 2E

Basin-wide Ecological Fate Model for Management of Chemicals Hazard,
W87-02975 5B

Vertical-Horizontal Transport and Fate of Low Water Solubility Chemicals in Unsaturated Soils,
W87-03074 2G

Field Validation of the Contaminant Transport Model, FEMA,
W87-03089 5B

Deterministic and Stochastic Analyses of Dispersion in an Unbounded Stratified Porous Medium,
W87-03196 5B

Upstream Weight Multiple-Cell Balance Finite-Element Method for Solving Three-Dimensional Convection-Dispersion Equations,
W87-03197 2F

New Formula for the Analytical Solution of the Radial Dispersion Problem,
W87-03199 2F

Model of Nitrogen Release from Bottom Sediments,
W87-03250 5B

Evaluation of the Factors Governing the Mobility of Dredged Material Placed at Open Water Disposal Sites,
W87-03252 5E

Numerical Prediction on the Effect of Phosphorus Release Control by Sediment Dredging,
W87-03253 5B

Ecological Evaluation of Organotin-Contaminated Sediment,
W87-03254 5B

Mussel Watch Program/Monitoring the Long-Term Effects of Dredged Material Disposal in New England Waters,
W87-03270 5B

Dissolved Loads of Rivers: A Global Overview,
W87-03273 5B

Variation in Solute Concentration Within the River Almond and Its Effect on the Estimated Dissolved Load,
W87-03274 5B

Physiogenic and Anthropogenic Controls of Global and Regional Ionic Runoff,
W87-03275 2E

Dissolved Loads in Streams and Rivers - Discharged and Seasonally Related Variations,
W87-03279 5B

Multivariate Analysis of Quality Parameters to Determine the Chemical Transport in Rivers,
W87-03280 5B

Mechanisms of Dissolved Solids Transport in Flysch Drainage Basins,
W87-03281 5B

Acid Rain: A Review of the Phenomenon in the EEC and Europe.
W87-03338 5C

PEA PLANTS
Water or Salt Stress Increases Infectivity of Erysiphe pisi Conidia Taken from Stressed Plants,
W87-03175 5C

PEARL MILLET
Water Deficit During Panicle Development in Pearl Millet: Yield Compensation by Tillers,
W87-03157 2I

PEARS
Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. I. Soil Moisture, Water Relations, Tree and Fruit Growth,
W87-03110 3F

Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. II. Mineral Composition of Fruit and Leaves, Fruit Disorders, and Fruit Set,
W87-03111 3F

PEAT
Non-Darcian Transmission of Water in Certain Humified Peats,
W87-02846 2G

PEAT BOGS
Hydraulic Conductivity and Related Physical Properties of Peat, Lost River Peatland, Northern Minnesota,
W87-02715 2G

PELTON TURBINES
Large Pelton Turbines for Canada's Cat Arm Scheme,
W87-02688 8C

PENNSYLVANIA
Overview of Pittsburgh District Selective Withdrawal Operation Experiences,
W87-03244 5G

PENSTOCKS
Taking Hydrology and Economic Factors into Account for Calculating the Economic Diameter of the Penstocks for High Head Micropower Plants, (Prise en Compte de l'Hydrologie et des Facteurs Economiques dans le Calcul du Diametre Economique des Conduites Forcees des Microcentrales Haute Chute),
W87-02568 8C

Waterhammer Pressure Compensation in Turbine Regulating Systems,
W87-02690 8C

PEPTIDES
Contaminating Peptides Widely Present in Ion-Exchanged Water, Reagents, Experimental Implements and Natural Sample,
W87-02787 5B

PERCOLATION
Soil Potential Ratings for Onsite Wastewater Disposal,
W87-02860 5E

PERFORMANCE EVALUATION
Virus Removal by Activated Sludge Treatment,
W87-02658 5D

Virus Inactivating Effect of Anaerobic Mesophilic Digestion of Municipal Sludge With or Without Different Preceding Types of Treatment,
W87-02661 5D

Study of Indigenous Virus Removal at Different Stages in a Drinking Water Plant Treating River Water,
W87-02665 5F

Biological Phosphorus Removal in Combination with Simultaneous Precipitation,
W87-02746 5D

Phosphorus Removal at Low Sludge Loadings,
W87-02747 5D

Factors Affecting Biological Removal of Phosphorus,
W87-02748 5D

Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-02751 5D

Application of Aluminas in Water Treatment,
W87-02752 5D

Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial Wastewater Reuse and Priority Pollutant Removal,
W87-02753 5D

Use of Ultraviolet Light in the Treatment of Water in Public Spas and Hot Tubs,
W87-02755 5F

Determination of Acrylic Acid in Aqueous Samples by Electron Capture Gas Chromatography after Extraction with Tri-n-octylphosphine Oxide and Derivatization with Pentafluorobenzyl Bromide,
W87-02818 5A

Characteristics of the Static Performance of Dams Reservoired Hydroelectric Stations,
W87-02866 8A

Stream Improvements and Fish Response: A Bio-engineering Assessment,
W87-02932 4A

Development of a Collision Tolerant Pile Structure Concept,
W87-03219 8A

Review of Selective Withdrawal Performance in the Fort Worth District,
W87-03229 6B

Selective Experiences: Alias Withdrawal Pains,
W87-03246 6B

Design and Performance of Skimming Weirs in the Kansas City District,
W87-03247 8A

PERIODIC REGRESSION
Statistical Technique for Analysis of Environmental Data Containing Periodic Variance Components,
W87-02599 7C

PERIPHYTON
Effects of Current Velocity and Light Energy on the Structure of Periphyton Assemblages in Laboratory Streams,
W87-02808 2H

PERMEABILITY COEFFICIENT
Hydraulic Conductivity and Related Physical Properties of Peat, Lost River Peatland, Northern Minnesota,
W87-02715 2G

Preferential Flow and Hydraulic Conductivity of Forest Soils,
W87-02724 2G

Estimating Generalized Soil-water Characteristics from Texture,
W87-02727 2G

Termination Criteria for Clay Permeability Testing,
W87-02788 2G

Non-Darcian Transmission of Water in Certain Humified Peats,
W87-02846 2G

Comparative Analysis of Transmissivity and Hydraulic Conductivity Values from the Ajali Aquifer System of Nigeria,
W87-02859 2F

Procedure to Identify Different Groups of Hydraulic-Conductivity and Moisture-Retention Curves for Soil Horizons,
W87-03075 2G

Evaporation and Redistribution of Salts in a Silt Loam Soil as Affected by Tillage Induced Soil Mulch,
W87-03168 3F

Physical Environment Near the Surface of Plowed and No-Tilled Soils,
W87-03171 2G

PEROXIDES

Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-03009 2I

PESTICIDES

Effects of Four Agricultural Pesticides on Daphnia pulex, Lemna minor, and Potamogeton pectinatus,
W87-02589 5C

Groundwater Contamination with Synthetic Organic Compounds and Pesticides in Suffolk County,
W87-02827 5B

Hazardout Waste Disposal: What Are the Options,
W87-03015 5E

Determination of Halogenated Solvent Residues in Water, Waste Water, Feeding-Stuffs, and Food, (Bestimmung halogenierter Losungsmittelruckstande in Wasser, Abwasser, Futter- und Lebensmitteln),
W87-03086 5A

PETROLEUM PRODUCTS

Under EPA Scrutiny: Underground Storage Tanks,
W87-03021 5B

PETUNIAS

Growth and Nutritional Status of Petunia and Tomato Seedlings with Acidified Irrigation Water,
W87-03105 5C

PHENOL

Halogenated Phenols in Water at Forty Canadian Potable Water Treatment Facilities,
W87-03112 5F

PHENOLIC ACIDS

Nonpoint Source Loading of Phenolic Acids from Decomposing Crop Residue,
W87-03161 5B

PHENOLS

Adsorption of Select Phenol Derivatives by Dolomite,
W87-02583 5B

Effects of Cyanide on the Methanogenic Degradation of Phenolic Compounds,
W87-02709 5D

PHOSPHATE BUDGET

Assessment of the Impact of Eutrophication Control Measures on South African Impoundments,
W87-02973 5G

PHOSPHATES

Behaviour of Intracellular Polyphosphate in the Biological Phosphate Removal Process,
W87-02735 5D

Polyphosphate Kinase Activity during Phosphate Uptake by Bacteria,
W87-02736 5D

Interaction of Different Groups of Micro-Organisms in Biological Phosphate Removal,
W87-02739 5D

New Strategies for the Isolation of Microorganisms Responsible for Phosphate Accumulation,
W87-02740 5D

Some Physiological Characteristics of Acinetobacter spp. Accumulating Large Amounts of Phosphate,
W87-02742 5D

Role of Bacterial Phosphate Metabolism in Enhanced Phosphorus Removal from the Activated Sludge Process,
W87-02743 5D

Exchange of Organics, Phosphate and Cations between Sludge and Water in Biological Phosphorus and Nitrogen Removal Processes,
W87-02745 5D

Maryland's Phosphate Ban-History and Early Results,
W87-02819 5G

Review of the Role of Bed Deposits in the Phosphate Eutrophication of Lakes and Rivers,
W87-03022 5B

Effect of Oxygen on Release and Uptake of Cobalt, Manganese, Iron and Phosphate at the Sediment-Water Interface,
W87-03143 5B

PHOSPHORUS

Efficient Method of Applying Aluminum Salts for Sediment Phosphorus Inactivation in Lakes,
W87-02635 5G

Problem of Phosphorus in France - Its Presence in Natural Waters and Biological Phosphorus Removal,
W87-02734 5G

Factors Affecting Biological Removal of Phosphorus,
W87-02748 5D

Biological Phosphorus Removal: A Technology Evaluation,
W87-02820 5D

Effect of Soil and Effluent Characteristics on Phosphorus Sorption in Dosed Columns,
W87-02861 2G

Macrophyte Growth in Shallow Streams: Field Investigations,
W87-02887 5C

Study on the Modelling of the Behavior of Phosphorus Released from Sediments,
W87-02967 2L

Three-dimensional Water-Quality-Transport Model Compared with Field Observations,
W87-02970 2H

Root Control of Leaf Phosphorus and Chlorine Accumulation in Soybean Under Salinity Stress,
W87-02984 2I

Evaluation of Methods for Preservation of Water Samples for Nutrient Analysis,
W87-03030 5A

Chemical Control of Soluble Phosphorus in the Amazon Estuary,
W87-03139 5B

Numerical Prediction on the Effect of Phosphorus Release Control by Sediment Dredging,
W87-03253 5B

PHOSPHORUS CYCLES

Review of the Role of Bed Deposits in the Phosphate Eutrophication of Lakes and Rivers,
W87-03022 5B

PHOSPHORUS EXPORT

Effect of Catchment Size on Phosphorus Export,
W87-02941 5B

PHOSPHORUS REMOVAL

Effect of Influent Phosphorus Reductions on Great Lakes Sewage Treatment Costs,
W87-02630 5D

Efficient Method of Applying Aluminum Salts for Sediment Phosphorus Inactivation in Lakes,
W87-02635 5G

Problem of Phosphorus in France - Its Presence in Natural Waters and Biological Phosphorus Removal,
W87-02734 5G

Behaviour of Intracellular Polyphosphate in the Biological Phosphate Removal Process,
W87-02735 5D

Polyphosphate Kinase Activity during Phosphate Uptake by Bacteria,
W87-02736 5D

Kinetics of Biological Phosphorus Release,
W87-02737 5D

Readily Biodegradable Fraction of Sewage: Its Influence on Phosphorus Removal and Measurement,
W87-02738 5D

Interaction of Different Groups of Micro-Organisms in Biological Phosphate Removal,
W87-02739 5D

New Strategies for the Isolation of Microorganisms Responsible for Phosphate Accumulation,
W87-02740 5D

Phosphorus Uptake by Klebsiella pneumoniae and Acinetobacter calcoaceticus,
W87-02741 5D

Some Physiological Characteristics of Acinetobacter spp. Accumulating Large Amounts of Phosphate,
W87-02742 5D

Role of Bacterial Phosphate Metabolism in Enhanced Phosphorus Removal from the Activated Sludge Process,
W87-02743 5D

Aut-Ecological Study of Acinetobacter in Activated Sludge,
W87-02744 5D

Exchange of Organics, Phosphate and Cations between Sludge and Water in Biological Phosphorus and Nitrogen Removal Processes,
W87-02745 5D

Biological Phosphorus Removal in Combination with Simultaneous Precipitation,
W87-02746 5D

Phosphorus Removal at Low Sludge Loadings,
W87-02747 5D

Factors Affecting Biological Removal of Phosphorus,
W87-02748 5D

Importance of the Acidogenic Microflora in Biological Phosphorus Removal,
W87-02749 5D

PHOSPHORUS REMOVAL

Biological Phosphorus and Nitrogen Removal at an Experimental Full Scale Plant in the U.K., W87-02750 5D

Biological Phosphorus Removal: A Technology Evaluation, W87-02820 5D

Macrophyte Growth in Shallow Streams: Biomass Model, W87-02888 5C

PHOSPORUS

Seasonal Growth and Composition and Accumulation of N-P-K in Dryland and Irrigated Pumpkins, W87-03150 2I

PHOSTRIP PROCESS

Biological Phosphorus Removal: A Technology Evaluation, W87-02820 5D

PHOTOSYNTHESIS

Effects of Temperature, Salinity, Irradiance and Diurnal Periodicity on Growth and Photosynthesis in the Diatom Nitzschia americana: Light-Saturated Growth, W87-02807 2L

Chromatic Regulation of Photosystem Composition in the Photosynthetic System of Red and Blue-Green Algae, W87-03212 2H

PHYSICOCHEMICAL PROPERTIES

Vertical Transport and Fate of Low-Water-Solubility Chemicals in Unsaturated Soils, W87-02836 5B

PHYSICOCHEMICAL TREATMENT

Bacteria and Viruses in Aerobically Digested Sludge: Influence of Physical and Chemical Treatments on Survival and Association with Flocs under Laboratory Conditions, W87-02660 5D

Identification of Promising Concepts for Treatment of Contaminated Sediments, W87-03256 5D

PHYTOPLANKTON

Interactive Algorithm for the Parameter Estimation of Complex Systems and Its Application to an Ecological Modelling of an Actual Japanese Lake, W87-02600 2H

Synthesis and Analysis of a Comprehensive Lake Model - With the Evaluation of Diversity of Ecosystems, W87-02965 2H

Study on the Modelling of the Behavior of Phosphorus Released from Sediments, W87-02967 2L

Interaction Between Motile Phytoplankton and Langmuir Circulation, W87-02969 2L

Three-dimensional Water-Quality-Transport Model Compared with Field Observations, W87-02970 2H

Association Between Some Planktonic Species and Physicochemical Characteristics of the Water of Loktak Lake, Manipur, India, W87-03025 2H

PICEANCE CREEK

Denudation of the Piceance Creek Basin, Colorado, W87-03289 2J

PIEZOMETRY

Regime of Ground Water of Semberian Aquifer, W87-03043 2F

PIGMENTATION

Underwater Light Climate and the Growth and Pigmentation of Planktonic Blue-Green Algae (Cyanobacteria) I. The Influence of light quantity, W87-02908 2H

Underwater Light Climate and the Growth and Pigmentation of Planktonic Blue-green Algae (Cyanobacteria) II. the Influence of Light Quality, W87-02909 2H

PILES

Development of a Collision Tolerant Pile Structure Concept, W87-03219 8A

PILOT PLANTS

Phosphorus Removal at Low Sludge Loadings, W87-02747 5D

Factors Affecting Biological Removal of Phosphorus, W87-02748 5D

Mixed-Culture Microbial Protein from Waste Sulfite Pulping Liquor II: Its Production on a Pilot-Plant Scale and Use in Animal Feed, W87-03132 5E

PIPE FLOW

Stability Criterion of a Laminar Flow, W87-02868 8B

PIPE LOCATORS

Instruments and Expertise Add Up to Good Pipe Locating, W87-02928 8C

PIPELINES

Experiencein the Manufacture and Installation of the Reinforced Concrete-Encased Steel Pipelines of the Zagorsk Pumped-Storage Station, W87-02869 8A

PIPES

Effects of Corrosion Control of Low Alkalinity Waters - Norwegian Experiences, W87-03045 5F

Restoration of Pipe Drainage in Foundations of Hydraulic Structures on Carbonate Rocks, W87-03184 8A

PITTSBURGH

Overview of Pittsburgh District Selective Withdrawal Operation Experiences, W87-03244 5G

PLACERS

Placers of Cosmic Dust in the Blue Ice Lakes of Greenland, W87-02913 2C

PLANKTON

Underwater Light Climate and the Growth and Pigmentation of Planktonic Blue-Green Algae (Cyanobacteria) I. The Influence of light quantity, W87-02908 2H

Underwater Light Climate and the Growth and Pigmentation of Planktonic Blue-green Algae (Cyanobacteria) II. the Influence of Light Quality, W87-02909 2H

Modelling of Stratified Flow and Eutrophication in Reservoirs, W87-02968 5C

PLANT GROWTH

Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: I. Salinity During Growth Modulates the Proton Pump in the Halophyte Atriplex Nummularia, W87-02717 2I

Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: II. K(+) Strongly Promotes Development of Membrane Potential in Vesicles from Cotton Roots, W87-02718 2I

Tips on Trickle, W87-02761 3F

Corn Yield Response to Irrigation, Plant Population and Nitrogen in a Cool, Humid Climate, W87-02878 3F

Soil Application of a Hydrophilic Conditioner in Relation to Moisture, Irrigation Frequency and Crop Growth, W87-02881 3F

Interactive Effects of Trickle Irrigation Rates, Cultivars, and Culture on Cut Chrysanthemum, W87-02959 3F

Differential Sensitivity of Turfgrass Organs to Water Stress, W87-02962 2I

Responses of Sugarbeet to Deficit, High-Frequency Sprinkler Irrigation. II. Sugarbeet Development and Partitioning to Root Growth, W87-02986 3F

Salinity Tolerance of Winged Bean as Compared With That of Soybean, W87-02988 3C

Growth and Yield of Sunflower and Soybean Under Soil Water Deficits, W87-02992 2I

Yield and Physiological Responses of Potatoes to Deficit, High Frequency Sprinkler Irrigation, W87-02997 3F

Water Use Efficiency in Soybean Pubescence Density Isolines-A Calculation Procedure for Estimating Daily Values, W87-03000 2I

Dryland Grain Sorghum Water Use, Light Interception, and Growth Response to Planting Geometry, W87-03008 2I

Survivorship and Spatial Development of Spartina alterniflora Loisel. (Gramineae) Seedlings in a New England Salt Marsh, W87-03096 2L

Relationships Between Growth and Measured Weather Factors Among Contrasting Varieties of Lolium, Dactylis and Festuca Species, W87-03100 2I

Growth and Nutritional Status of Petunia and Tomato Seedlings with Acidified Irrigation Water, W87-03105 5C

Muskmelon Growth, Yield, and Nutrition as Influenced by Planting Method and Trickle Irrigation, W87-03108 3F

Ammonium (15N) Metabolism in Cotton Under Salt Stress, W87-03151 5C

Boron Tolerance and Accumulation in the Duckweed, Lemna minor, W87-03152 5C

Salt Responses of Lettuce to Salinity. II. Effect of Calcium on Growth and Mineral Status, W87-03155 5C

Contrasting Response to Salt Stress of Two Salinity Tolerant Creeping Bentgrass Clones, W87-03156 5C

Water Deficit During Panicle Development in Pearl Millet: Yield Compensation by Tillers,
W87-03157 2I

Effects of In-Row and Interrow Subsoiling and Time of Nitrogen Application on Growth, Stomatal Conductance and Yield of Strip-Tilled Corn,
W87-03170 3F

Growth and Survival of Giant Ragweed (Ambrosia trifida L.) in a Delaware River Freshwater Tidal Wetland,
W87-03207 2H

Chemical Mass Balance of a Small Basin in a Wet Monsoonal Environment and the Effect of Fast-Growing Plantation Forest,
W87-03291 2H

Feasibility of Using Mycorrhizal Fungi for Enhancement of Plant Establishment on Dredged Material Disposal Sites: A Literature Review,
W87-03316 3D

PLANT GROWTH MODELS

Ecological Modelling, Monitoring and Implementation in Irrigated Agriculture,
W87-02966 3F

PLANT NUTRITION

Growth and Nutritional Status of Petunia and Tomato Seedlings with Acidified Irrigation Water,
W87-03105 5C

Muskmelon Growth, Yield, and Nutrition as Influenced by Planting Method and Trickle Irrigation,
W87-03108 3F

Seasonal Growth and Composition and Accumulation of N-P-K in Dryland and Irrigated Pumpkins,
W87-03150 2I

PLANT PHYSIOLOGY

Salt Tolerance in the Triticeae: Salinity-Induced Changes in the Leaf Solute Composition of Some Perennial Triticeae,
W87-02785 2I

Alcohol Dehydrogenase Activity in the Roots of Marsh Plants in Naturally Waterlogged Soils,
W87-02816 2I

Yield and Physiological Responses of Potatoes to Deficit, High Frequency Sprinkler Irrigation,
W87-02997 3F

PLANT TISSUES

Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-03010 2I

PLANT WATER POTENTIAL

Techniques for Measuring Plant Water,
W87-02950 7B

Methods of Inducing Water Stress in Plants,
W87-02951 2I

Soil Compaction and Moisture Stress Preconditioning in Kentucky Bluegrass. II. Stomatal Resistance, Leaf Water Potential, and Canopy Temperature,
W87-02983 2G

Effect of Short-term Water Stress on Leaf Gas Exchange Processes and Plant Water Potential in Schefflera,
W87-03104 2I

Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. I. Soil Moisture, Water Relations, Tree and Fruit Growth,
W87-03110 3F

Ammonium (15N) Metabolism in Cotton Under Salt Stress,
W87-03151 5C

PLANT WATER RELATIONS

Seasonal Growth and Composition and Accumulation of N-P-K in Dryland and Irrigated Pumpkins,
W87-03150 2I

Water or Salt Stress Increases Infectivity of Erysiphe pisi Conidia Taken from Stressed Plants,
W87-03175 5C

PLASMID TRANSFER

R-Plasmid Transfer in Soil and Water,
W87-02792 5C

PLOWING

Mechanized Tillage Systems Effects on Properties of a Tropical Alfisol in Watersheds Cropped to Maize,
W87-03162 2G

PLUMBING

Lead Dissolution From Soldered Joints,
W87-02607 5B

POLICY MAKING

Stemming the Loss of Coastal Wetland Habitats: Jamaica as a Model for Tropical Developing Countries,
W87-03128 2L

POLIOVIRUS

Humic Acid Interference with Virus Recovery by Electropositive Microporous Filters,
W87-02900 5A

POLITICAL ASPECTS

Low Level Radioactive Waste Disposal--Technology and Public Policy,
W87-02775 5E

POLLUTANT DISPERSION

Modeling of Pollutant Dispersion in Stratified Oscillatory Flows,
W87-02885 5B

POLLUTANT IDENTIFICATION

Detection of Rotavirus in Treated Drinking Water,
W87-02643 5B

Genomic Analysis of RNA Viruses Isolated from Water,
W87-02645 5A

Detection of Hepatitis A Virus (HAV) in Drinking Water,
W87-02646 5A

Detection of Hepatitis A Virus in Drinking Water by Enzyme-Immunoassay Using Ultracentrifugation for Virus Concentration,
W87-02647 5A

Recovery of Viruses from Drinking-Water by Means of an In-Line Electropositive Cartridge Filter,
W87-02649 5A

Concentration of Viruses from Water Using Pig Erythrocyte Ghost Cells,
W87-02650 5A

Detection of Enteroviruses: An Assessment of Ten Cell Lines,
W87-02651 5A

Analysis of Tap Water for Viruses: Results of a Survey,
W87-02652 5A

Detection and Health Risk Associated with Low Virus Concentration in Drinking Water,
W87-02653 5A

Failure to Detect Cytopathic Enteroviruses in Drinking Water,
W87-02654 5A

Some Experimental Discussion of Accuracies in Quantitative Virus Assessment for Water Supply,
W87-02656 5A

Interactions between Biotic and Abiotic Factors and Viruses in a Water System,
W87-02657 5B

Detection of Indigenous Enteric Viruses in Raw Sewage Effluents of the City of Athens, Greece, during a Two Year Survey,
W87-02659 5B

Detection and Stability of Enteric Viruses in Sludge, Soil and Ground Water,
W87-02662 5B

Organic and Trace Metal Levels in Ocean Quahog, Arctica islandica Linne, from the Northwestern Atlantic,
W87-02759 5B

Automated Prevalve Dilution in Flow-Injection Analysis: The Automated Determination of Chloride in Surface, Ground and Domestic Water,
W87-02793 5A

Possibilities of Improving the Determination of Extremely Low Lead Concentrations in Marine Fish by Graphite Furnace Atomic Absorption Spectrometry,
W87-02794 5A

Determination of Acrylic Acid in Aqueous Samples by Electron Capture Gas Chromatography after Extraction with Tri-n-octylphosphine Oxide and Derivatization with Pentafluorobenzyl Bromide,
W87-02818 5A

Continuous Monitoring of 222Rn Concentration in Unconfined Groundwater,
W87-02847 5A

Partitioning of 7 Beryllium in Fresh Water,
W87-03142 5A

POLLUTANTS

Anomalous Binding of Organic Contaminants May Be Artifactual Due to Radiochemical Impurities,
W87-02700 5A

Immiscible Contaminant Transport in Soils and Groundwater with an Emphasis on Petroleum Hydrocarbons: System of Differential Equations vs Single Cell Model,
W87-02729 5B

POLLUTION

Water and the Third Millennium,
W87-03044 5F

POLLUTION LOAD

Modeling for Estimating Representative Water Conditions in a River Basin,
W87-02604 5B

Dissolved and Particulate Load in Danish Water Courses,
W87-03293 5B

Nitrate Load/Discharge Relationships and Nitrate Load Trends in Danish Rivers,
W87-03302 5B

POLLUTION TOLERANCE

Acute and Chronic Toxicity of Nickel to Larvae of Chironomus riparis (Meigen),
W87-03083 5C

POLLUTION TRANSPORT
Basin-wide Ecological Fate Model for Management of Chemicals Hazard,
W87-02975 5B

POLYACRYLAMIDE
Polyacrylamide Application in Irrigation Water to Increase Infiltration,
W87-02911 2G

POLYCHLORINATED BIPHENYLS
Overview of PCB Pollution and its Behavior in Seine River, (Apercu sur la Pollution par les P.C.B. (Polychlorobiphenyles) en Seine, et son Comportement),
W87-02564 5B

Determination of Halogenated Solvent Residues in Water, Waste Water, Feeding-Stuffs, and Food, (Bestimmung halogenierter Losungsmittelruckstande in Wasser, Abwasser, Futter- und Lebensmitteln),
W87-03086 5A

POLYMERIC LIQUID CHROMATOGRAPHY
HPLC Anion Exclusion Method for Fluoride Determinations in Complex Effluents,
W87-03094 5A

POLYMERS
Microbial Polymers in the Aquatic Environment-I: Production by Activated Sludge Microorganisms under Different Conditions,
W87-02694 5D

Microbial Polymers in the Aquatic Environment-II: Isolation from Biologically Non-purified and Purified Municipal Waste Water and Analysis,
W87-02695 5D

Microbial Polymers in the Aquatic Environment-III: Isolation from River, Potable and Underground Water and Analysis,
W87-02696 5B

Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-02751 5D

Effects of Soil Conditioners on Water Relationships in Soils,
W87-02910 2G

Innovative Lagoon Liner Pays Off,
W87-03078 5D

POLYPHOSPHATE KINASE
Polyphosphate Kinase Activity during Phosphate Uptake by Bacteria,
W87-02736 5D

PONDS
Nutrient Transformation in Retention/Detention Ponds Receiving Highway Runoff,
W87-02821 5D

Pond Maintenance,
W87-03018 4A

POPULATION DENSITY
Patterns in Distribution and Abundance of a Noncoevolved Assemblage of Estuarine Fishes in California,
W87-02758 2L

POPULATION DYNAMICS
Modelling of Stratified Flow and Eutrophication in Reservoirs,
W87-02968 5C

POPULATION EXPOSURE
Exposure to Fluoridated Public Water Supplies and Child Health and Behaviour,
W87-03092 5C

PORES
Distribution Function Approach to Water Flow in Soil Macropores Based on Kinematic Wave Theory,
W87-02858 2G

POROUS MEDIA
Deterministic and Stochastic Analyses of Dispersion in an Unbounded Stratified Porous Medium,
W87-03196 5B

POROUSMEDIA
Aquifer Transmissivity of Porous Media from Resistivity Data,
W87-02837 7B

PORT DEPOSIT
Pump Station Gets Navy Discharge and New Life as Civilian,
W87-02925 5F

PORTLAND CEMENTS
Latex Admixtures for Portland Cement Concrete and Mortar,
W87-03318 8G

PORTUGAL
Small Power Stations Abroad, (Aspects Specifiques de Minicentrales a l'Etranger),
W87-02566 8C

POTABLE WATER
Fungi in Potable Water Distribution Systems,
W87-02614 5B

Microbial Polymers in the Aquatic Environment-III: Isolation from River, Potable and Underground Water and Analysis,
W87-02696 5B

Asbestos in Potable Water Supplies and Attributable Risk of Gastrointestinal Cancer,
W87-02830 5C

Comparison of Clark's Presence-Absence Test and the Membrane Filter Method for Coliform Detection in Potable Water Samples,
W87-02892 5A

POTASSIUM
Potassium Utilization and Fluxes in Wild Salt-Tolerant Relatives of the Cultivated Tomato,
W87-03055 2I

Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. II. Mineral Composition of Fruit and Leaves, Fruit Disorders, and Fruit Set,
W87-03111 3F

Seasonal Growth and Composition and Accumulation of N-P-K in Dryland and Irrigated Pumpkins,
W87-03150 2I

Salt Responses of Lettuce to Salinity. II. Effect of Calcium on Growth and Mineral Status,
W87-03155 5C

POTATOES
Yield and Physiological Responses of Potatoes to Deficit, High Frequency Sprinkler Irrigation,
W87-02997 3F

POTATOES YIELD
Effect of Subsoiling and Irrigation on Potato Production,
W87-03169 3F

POTOMAC RIVER
Bloomington Dam, Potomac River Water Quality Outlet,
W87-03231 5G

Nutrient and Sediment Budgets for the Tidal Potomac River and Estuary,
W87-03290 5B

POWDERY MILDEW
Water or Salt Stress Increases Infectivity of Erysiphe pisi Conidia Taken from Stressed Plants,
W87-03175 5C

POWELL LAKE
Vertical Diffusion in Meromictic Powell Lake, British Columbia,
W87-02780 2H

POWER HEAD
Taking Hydrology and Economic Factors into Account for Calculating the Economic Diameter of the Penstocks for High Head Micropower Plants, (Prise en Compte de l'Hydrologie et des Facteurs Economiques dans le Calcul du Diametre Economique des Conduites Forcees des Microcentrales Haute Chute),
W87-02568 8C

Creation of a Cross-Flow Turbines Range, (Creation d'une Gamme de Turbines a Flux Traversant),
W87-02569 8C

Small Hydroelectric Power Plants for Very Low Heads, (Les Usines de Tres Basse Chute en Mini-Hydroelectricite),
W87-02571 8C

POWER STATION AUTOMATIC CONTROL SYSTEM
Automation of a Chain of Run-of-River Power Stations,
W87-03035 8C

POWERPLANTS
Economy and Performance of Small Turbines, (Economie et Performance des Petites Turbines),
W87-02570 8C

Problems Encountered in The Operation of Small Power Plants, (Problemes Rencontres a la Mise en Service de Microcentrales),
W87-02572 8C

Small Hydroelectric Plants and Environemental Protection, (Petite Hydraulique et Protection de l'Environment),
W87-02573 8C

Adaptation of an Existing Sill for Installation of a Siphon Plant, (Adaptation d'un Seuil Existant pour l'Implantation d'un Groupe en Siphon),
W87-02574 8C

Standardized Design and Units for Small Hydroprojects 10 to 20 m Head, (Projets et Materiels Standards pour Petits Amenagements Hydrauliques de 10 a 20 m de Chute),
W87-02576 8C

Passive Screen Water Intake Design Studies,
W87-02767 8I

PRAIRIES
Plains Cottonwood Recruitment and Survival on a Prairie Meandering River Floodplain, Milk River, Southern Alberta and Northern Montana,
W87-02769 2I

PRECIPITATION
Dual-use Filters Keep Wet-weather Flows Under Control,
W87-02926 5D

Response of Cloud Supersaturation to Radiative Forcing,
W87-03214 2B

Structure, Energetics and Propagation of Rotating Convective Storms. Part I: Energy Exchange with the Mean Flow,
W87-03215 2B

Interim Progress Report, Volume I: SCPP Meteorological and Statistical Support for Period 1 September 1984 through 31 August 1985,
W87-03327 2B

PRECIPITATION BANDS
Possible Role of Symmetric Instability in the Formation of Precipitation Bands,
W87-03213 2B

PREDATION
Effects of Variation in Streamside Habitats on the Composition of Mountain Salamander Communities,
W87-03082 2H

PREDICTION
Validation of a Prognosis Based Upon a Eutrophication Model,
W87-02602 5C

Water Use in Urban Korea,
W87-02617 6D

Use of Climate Predictions to Decide a Water Management Problem,
W87-02633 6A

Real-Time Kinematic Catchment Model for Hydro Operation,
W87-02766 2E

PREFERENTIAL FLOW
Preferential Flow and Hydraulic Conductivity of Forest Soils,
W87-02724 2G

PRESERVATION
Evaluation of Methods for Preservation of Water Samples for Nutrient Analysis,
W87-03030 5A

PRIMARY PRODUCTIVITY
Primary Productivity (C14) at Twin Lakes Colorado: 1973-81 Study Results,
W87-03326 2H

PROBABILISTIC PROCESS
Impacts of Water Quality Improvement on Site Visitation: A Probabilistic Modeling Approach,
W87-02622 4D

PROBABLE MAXIMUM PRECIPITATION
Evolution of PMP Cooperative Studies,
W87-03063 8A

PROCESS CONTROL
$5.00, 1-Minute Effluent Quality Tester,
W87-02814 7B

Getting Your Money's Worth from Computer Based Control Systems - Part 1,
W87-03120 5D

PROCESS WATER
Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-02751 5D

Application of Aluminas in Water Treatment,
W87-02752 5D

PROJECT PLANNING
Water Supply in Developing Countries: Improving on Current Practice,
W87-02784 5G

PROTECTION
Indiana Waste Days Beyond Expectations,
W87-02757 5G

PROTEINS
Effect of Irrigation and Nitrogen Fertilizer on the Yield and Protein Content of Soft White Spring Wheat,
W87-02877 3F

Ammonium (15N) Metabolism in Cotton Under Salt Stress,
W87-03151 5C

PROTOZOA
Operator's Guide to Protozoa and their Role in the Activated Sludge Process,
W87-02903 5D

PROVENCE
Problems Encountered in The Operation of Small Power Plants, (Problemes Rencontres a la Mise en Service de Microcentrales),
W87-02572 8C

PSKEM RIVER
Pskem Hydro Development on the Pskem River,
W87-02870 8A

PUBLIC ACCESS
Fishing from the Bank: Public Recreational Rights along Idaho's Rivers and Lakes,
W87-02594 6E

PUBLIC HEALTH
Rotavirus Survival in Raw and Treated Waters and Its Health Implications,
W87-02644 5G

Detection and Health Risk Associated with Low Virus Concentration in Drinking Water,
W87-02653 5A

Failure to Detect Cytopathic Enteroviruses in Drinking Water,
W87-02654 5A

Water and Hygiene: The Case of North Carolina Farmworkers,
W87-02756 6D

Human Viruses in Sediments, Sludges, and Soils,
W87-02768 5B

Sanitary Study of Surface Water and of the Beach of a Water Sports and Leisure Complex,
W87-02777 5B

Prevention and Treatment of Endemic Iodine-Deficiency Goiter by Iodination of a Municipal Water Supply,
W87-02779 5F

R-Plasmid Transfer in Soil and Water,
W87-02792 5C

Exposure to Fluoridated Public Water Supplies and Child Health and Behaviour,
W87-03092 5C

PUBLIC OPINION
Cost of Pure Water,
W87-02642 5G

PUBLIC POLICY
National Water Policy -- Does Anybody Want One,
W87-02619 6E

Water and Hygiene: The Case of North Carolina Farmworkers,
W87-02756 6D

Low Level Radioactive Waste Disposal--Technology and Public Policy,
W87-02775 5E

Coastal Flood Insurance,
W87-02782 6F

Public Policy Implications of Toxic Chemicals in Drinking Water: A Case Study of Long Island, NY,
W87-02826 5C

Drought Policy in the U.S. and Australia: A Comparative Analysis,
W87-02937 6E

PUBLIC RIGHTS
Fishing from the Bank: Public Recreational Rights along Idaho's Rivers and Lakes,
W87-02594 6E

PUMP STATIONS
Pump Station Gets Navy Discharge and New Life as Civilian,
W87-02925 5F

PUMPED STORAGE
Effect of the Shape of the Transition Section on Head Losses in Intakes of a Pumped-Storage Station,
W87-02867 8A

Experiencein the Manufacture and Installation of the Reinforced Concrete-Encased Steel Pipelines of the Zagorsk Pumped-Storage Station,
W87-02869 8A

Overspeeding Processes in Reversible Units of Pumped-Storage Stations,
W87-03179 8C

Low-Head Pumped-Storage Station as a Way of Expanding the Tsimlyansk Hydroelectric Station,
W87-03182 8C

PUMPING PLANTS
Analysis of Transient Phenomena in Hydroelectric Generation Plants, (Calcul des Transitoires dans les Installations Hydrauliques de Production d'Energie),
W87-02580 8C

Assessment of Odorous Emissions from Sewage Pumpstations,
W87-03029 5D

Pump Station's Cost Reduced Dramatically,
W87-03121 5D

PUMPING TESTS
Response to Pumping of a Weathered-Fractured Granite Aquifer,
W87-02676 2F

New Analogue Computer for the Study of Pumping Tests under Falling Water-Table Conditions,
W87-02854 7B

Results of Pumping Tests in the Deccan Trap Basalts of Central India,
W87-03076 2F

PUMPKINS
Seasonal Growth and Composition and Accumulation of N-P-K in Dryland and Irrigated Pumpkins,
W87-03150 2I

R.D. BAILEY LAKE
Selective Experiences: Alias Withdrawal Pains,
W87-03246 6B

RADIAL DISPERSION
New Formula for the Analytical Solution of the Radial Dispersion Problem,
W87-03199 2F

RADIATION
Radiation Induced Decomposition of Some Chlorinated Methanes in Water,
W87-02702 5D

Response of Cloud Supersaturation to Radiative Forcing,
W87-03214 2B

RADIOACTIVE WASTE DISPOSAL
Low Level Radioactive Waste Disposal--Technology and Public Policy,
W87-02775 5E

RADIOACTIVE WASTES
Geochemical and Environmental Processes Affecting Radionuclide Migration from a Formerly Used Seepage Trench,
W87-03135 5E

RADIOCHEMICAL ANALYSIS
Anomalous Binding of Organic Contaminants May Be Artifactual Due to Radiochemical Impurities,
W87-02700 5A

RADIOISOTOPES
Continuous Monitoring of 222Rn Concentration in Unconfined Groundwater,
W87-02847 5A

RADIONUCLIDES
Drinking-Water Contribution to Natural Background Radiation,
W87-03084 5F

Radionuclide Concentrations in Louisiana Soils and Sediments,
W87-03085 5B

RADON
Drinking-Water Contribution to Natural Background Radiation,
W87-03084 5F

RADONISOTOPES
Continuous Monitoring of 222Rn Concentration in Unconfined Groundwater,
W87-02847 5A

RAGWEED
Growth and Survival of Giant Ragweed (Ambrosia trifida L.) in a Delaware River Freshwater Tidal Wetland,
W87-03207 2H

RAIN
Measurements of pH versus Drop Size in Natural Rain,
W87-02811 2B

Environmental Chemistry of Rainwater in Sri Lanka,
W87-03023 2B

RAIN EVENTS
Characterization of Water Using Combined Sewer Overflows, (Caracterization des Eaux Usees de Debordements de Reseau Unitaire),
W87-02672 5B

RAINBOW TROUT
Absence of Acclimation to Parathion by Rainbow Trout During Sublethal Exposure,
W87-02697 5C

Avoidance-Preference Reactions of Rainbow Trout (Salmo Gairdneri) After Prolonged Exposure to Chromium(VI),
W87-02698 5C

RAINDROP SIZE
Measurements of pH versus Drop Size in Natural Rain,
W87-02811 2B

RAINFALL
Study of Acid Deposition in Switzerland: Temporal Variation in the Ionic Composition of Wet Precipitation at Rural Sites During 1983-1984,
W87-02763 5B

Determination of Rainfall Excess on Spatially Variable Catchments,
W87-02853 2A

Regime of Ground Water of Semberian Aquifer,
W87-03043 2F

Response of Conservation Tillage Sorghum to Growing Season Precipitation,
W87-03167 3F

RAINFALL CHEMISTRY
Environmental Chemistry of Rainwater in Sri Lanka,
W87-03023 2B

RAINFALL COLLECTORS
Lessons from Field Experience with Rainwater Collection Systems in Africa and Asia,
W87-03042 5F

RAINFALL FORECASTING
Use of Climate Predictions to Decide a Water Management Problem,
W87-02633 6A

RAINFALL INTENSITY
Explicit Solution of the Modified Horton Equation,
W87-02850 2G

RAINFALL-RUNOFF RELATIONSHIPS
Effect of Rainfall Excess Calculations on Modeled Hydrograph Accuracy and Unit-Hydrograph Parameters,
W87-02623 2B

Review of Field Observations of Runoff Generation in the Tropics,
W87-02675 2E

Real-Time Kinematic Catchment Model for Hydro Operation,
W87-02766 2E

Compaction, Hydrological Processes and Soil Erosion on Loamy Sands in East Shropshire, England,
W87-03160 2J

RAINFALL-RUNOFF RELATIONSHIPS.
RAINFALL
Meteorological Data Analysis for Drainage System Design,
W87-02882 2B

RAINOUT SHELTERS
Use of Portable Rainout Shelters to Induce Water Stress,
W87-02991 2I

RAINSTORMS
Structure, Energetics and Propagation of Rotating Convective Storms. Part I: Energy Exchange with the Mean Flow,
W87-03215 2B

RAPID EXCAVATION
Tunnels: Machine Excavation - Rate of Progress - Machine Data,
W87-03320 8A

RAW WATER
Trihalomethane Levels in Chlorinated Michigan Drinking Water,
W87-02605 5F

Cost Analysis of the Adverse Effects of Algal Growth in Water Bodies on Drinking Water Supply,
W87-02977 5F

REAGENTS
Contaminating Peptides Widely Present in Ion-Exchanged Water, Reagents, Experimental Implements and Natural Sample,
W87-02787 5B

RECHARGE VOLUME
Examination of the Mechanisms Controlling Groundwater Gradients in Hyper-Arid Regional Sedimentary Basins,
W87-02942 2F

RECREATION
Fishing from the Bank: Public Recreational Rights along Idaho's Rivers and Lakes,
W87-02594 6E

Chubb/Bauman Method for Estimating the Recreation Potential of Rivers: A Critical Review,
W87-02634 6A

Sanitary Study of Surface Water and of the Beach of a Water Sports and Leisure Complex,
W87-02777 5B

RECREATION DEMAND
Impacts of Water Quality Improvement on Site Visitation: A Probabilistic Modeling Approach,
W87-02622 4D

Travel Cost Model for Lake Recreation: A Comparison of Two Methods for Incorporating Site Quality and Substitution Effects,
W87-02872 6D

RECREATION FACILITIES
Use of Ultraviolet Light in the Treatment of Water in Public Spas and Hot Tubs,
W87-02755 5F

RECYCLING
Trickle Irrigation System for Recycling Residential Wastewater on Fruit Trees,
W87-02955 3C

Recycling Irrigation Runoff on Container Ornamentals,
W87-02956 3F

Water Conservation and Recycling in Ornamentals Production,
W87-02957 3F

RED ALGAE
Chromatic Regulation of Photosystem Composition in the Photosynthetic System of Red and Blue-Green Algae,
W87-03212 2H

RED RIVER
Lock and Dam 1, Red River Waterway: Hydraulic Model Investigation,
W87-03333 8B

REFERENCE VALUE STANDARDS
Predicting Standard pH Values for Reference Buffer Solutions in Solvent Mixtures with Water,
W87-03049 5A

REFERENDA
Voter Reactions to the 1976 Water Development and Quality Referenda in Texas,
W87-02944 6E

REFORESTATION
Modelling the Effects of Acidic Deposition And Conifer Afforestation on Stream Acidity in the British Uplands,
W87-03068 5C

Changes in Catchment Runoff Following Drainage and Afforestation,
W87-03072 4C

REGIONAL ANALYSIS
Regional Analysis of Water Quality in Major Streams of the United States,
W87-03284 5G

REGIONAL DEVELOPMENT
National Water Policy – Does Anybody Want One,
W87-02619 6E

REGIONAL PLANNING
Water Supply in the Northeast: A Study in Regulatory Failure,
W87-02590 6E

Long Distqance Water Rights,
W87-02637 6E

REGULATING SYSTEMS
Waterhammer Pressure Compensation in Turbine Regulating Systems,
W87-02690 8C

REGULATIONS
Small Hydroelectric Plants and Environemental Protection, (Petite Hydraulique et Protection de l'Environment),
W87-02573 8C

Water Supply in the Northeast: A Study in Regulatory Failure,
W87-02590 6E

REGULATORY FAILURE
Water Supply in the Northeast: A Study in Regulatory Failure,
W87-02590 6E

REINFORCED CONCRETE
Experiencein the Manufacture and Installation of the Reinforced Concrete-Encased Steel Pipelines of the Zagorsk Pumped-Storage Station,
W87-02869 8A

REMOTE SENSING
Remote Sensing Techniques for Assessing Water Deficits and Modeling Crop Response,
W87-02953 7B

REPRODUCTION
Survivorship and Spatial Development of Spartina alterniflora Loisel. (Gramineae) Seedlings in a New England Salt Marsh,
W87-03096 2L

RESEARCH FACILITIES
History of the Federal-State Cooperative Water Resources Research Institute Program,
W87-02632 9D

RESERVOIR OPERATION
Reservoir Regulation and Selective Withdrawal in Oregon,
W87-03226 6D

Operation of Selective Withdrawal Facilities: Libby Dam, Montana,
W87-03227 5C

Alternatives for Improving Reservoir Water Quality,
W87-03228 5G

Operational Tools: Selective Withdrawal and Daily Operational Strategy,
W87-03238 5G

Operational Tools: Optimal Control of Reservoir Water Quality,
W87-03239 5G

RESERVOIR RELEASES
Wave Movement and Water-Quality Variations During a Controlled Release from Kielder Reservoir, North Tyne River, U. K.,
W87-02681 2E

RESERVOIR SILTING
Forecasting Sediment Distribution in Reservoirs During Unstable Conditions,
W87-02680 2J

RESERVOIRS
Virginia, North Carolina Wage Water-Rights Battle,
W87-02638 6E

Characteristics of the Static Performance of Dams Reservoired Hydroelectric Stations,
W87-02866 8A

Management of Instream Flows through Runoff Detention and Retention,
W87-02934 4A

Modelling of Stratified Flow and Eutrophication in Reservoirs,
W87-02968 5C

Assessment of the Impact of Eutrophication Control Measures on South African Impoundments,
W87-02973 5G

Rockfall-Induced Waves in Reservoirs,
W87-03037 8E

Statistical Methods for Reservoir Water Quality Investigations,
W87-03322 7C

RESIDUAL LEVELS
Insecticides and Metals in Nigerian Surface Water - Warri River,
W87-03028 5B

RESINS
Ion-Exchange Resin Samplers for the In-Site Measurement of Major Cations in Soilwater Solute Flux,
W87-02678 7B

RESISTANCE
Resistance of Plant Roots to Water Loss,
W87-03005 2I

RESISTIVITY
Aquifer Transmissivity of Porous Media from Resistivity Data,
W87-02837 7B

RESOURCES DEVELOPMENT
Existence Values and Normative Economics: Implications for Valuing Water Resources,
W87-03188 6B

RESOURCES MANAGEMENT
More Awareness Sought Concerning Role of Metals in Pollution,
W87-02791 5B

RETARDANCE
Retardation of Toxic Chemicals in a Contaminated Outwash Aquifer,
W87-02731 5B

Transport of Solutes in Soil: Basic Features of Front Retardation,
W87-02733 5B

RETENTION
Management of Instream Flows through Runoff Detention and Retention,
W87-02934 4A

RETENTION PONDS
Nutrient Transformation in Retention/Detention Ponds Receiving Highway Runoff,
W87-02821 5D

REVELSTOKE
Geological Problems Overcome at Revelstoke: Part Two,
W87-02692 8D

REVERSE OSMOSIS
Reverse Osmosis Can Be Cost Effective,
W87-03079 3A

REVIEWS
Review and Analysis of Methods for Quantifying Instream Flow Requirements,
W87-02933 6D

RHINE RIVER
Statistical Analysis of the Relationship Between Water Quality Parameters and Discharge at Eight Stations on the Rhine from 1959 to 1974 (Analyse Statistique des Relations Liant les Parametres de Qualite d'Eau et le Debit du Rhin en Huit Stations de 1959 a 1974),
W87-03282 5G

Dissolved and Suspended Loads of the Regulated River Nidda in the Rhine-Main Area,
W87-03299 5B

RHONE RIVER
Distribution of Anionic Surfactants in the Water Column of the Gulf of Fos-sur-Mer, (Distribution des Detergents Anioniques dans la Colonne d'Eau du Golfe de Fos-sur-Mer),
W87-02563 5B

Energy Recovery Small Hydro Plants on the Rhone River. The First Months of Operation of Champagneux Power Plant and the Sault-Brenaz Project, (Les Petites Centrales de Recuperation sur le Rhone. Les Premiers Mois d' Exploitation de la Centrale de Champagneux et le Project de Sault-Brenaz),
W87-02575 8C

RIBULOSE BIPHOSPHATE CARBOXYLASE
Effects of Light on Growth, RuBPCase Activity and Chemical Composition of Ulva Species (Chlorophyta),
W87-02809 2L

RICE
Effect of Cultivated and Wild Rice Varieties on the Nitrogen Balance of Flooded Soil,
W87-02813 2I

Comparison of Sprinkler and Flood Irrigation for Rice,
W87-03004 3F

Herbicides and Seeding Rate Effects on Sprinkler-Irrigated Rice,
W87-03013 2I

Forms of Nitrogen in Waterlogged Soils and Their Contribution to Yield and Nitrogen Uptake by Rice,
W87-03158 3C

Compaction and Tillage Depth Combinations for Water Management and Rice Production in Low-Retentive Permeable Soils,
W87-03163 3F

Effects of Tillage Methods and Water Regimes on Soil Properties and Yield of Lowland Rice from a Sandy Loam Soil in Southwest Nigeria,
W87-03164 2I

RIPRAP
Riprap Stability and Navigation Tests for the Divide-Cut Section Tennessee-Tombigbee Waterway,
W87-03317 8A

RISKS
Detection and Health Risk Associated with Low Virus Concentration in Drinking Water,
W87-02653 5A

RIVER ALMOND
Variation in Solute Concentration Within the River Almond and Its Effect on the Estimated Dissolved Load,
W87-03274 5B

RIVER BEDS
Erosion of Unconsolidated Gravel Beds,
W87-02673 2J

RIVER FLOW
Comparison of MOBED and HEC-6 River Flow Models,
W87-02669 2E

Mixing Coefficient for Ice-covered and Free-surface Flows,
W87-02671 2E

Transport of Gravel by Flows up to 500 cu m/s, Ohau River, Otago, New Zealand,
W87-02773 2J

RIVER LAHN
Studies on Sediments of the River Lahn: 1. Analytical Results, (Untersuchungen an Lahnsedimenten: 1. Analytische Ergebnisse),
W87-02800 5B

Studies on Sediments of the River Lahn: 2. Chemometric Evaluation, (Untersuchungen an Lahnsedimenten: 2. Chemometrische Auswertung),
W87-02801 5B

RIVER SEDIMENTS
Radionuclide Concentrations in Louisiana Soils and Sediments,
W87-03085 5B

RIVER SYSTEMS
Environmental Effects of Dikes and Revetments on Large Riverine Systems,
W87-03321 6G

RIVER WATER
Fluorometric Determination of Nitrite in Natural Waters with 3-Aminonaphthalene-1,5-disulphonic Acid by Flow-Injection Analysis,
W87-03172 5A

RIVERS
Modeling for Estimating Representative Water Conditions in a River Basin,
W87-02604 5B

Chubb/Bauman Method for Estimating the Recreation Potential of Rivers: A Critical Review,
W87-02634 6A

Interactions between Biotic and Abiotic Factors and Viruses in a Water System,
W87-02657 5B

Study of Indigenous Virus Removal at Different Stages in a Drinking Water Plant Treating River Water,
W87-02665 5F

Microbial Polymers in the Aquatic Environment-III: Isolation from River, Potable and Underground Water and Analysis,
W87-02696 5B

Plains Cottonwood Recruitment and Survival on a Prairie Meandering River Floodplain, Milk River, Southern Alberta and Northern Montana,
W87-02769 2I

Review of the Role of Bed Deposits in the Phosphate Eutrophication of Lakes and Rivers,
W87-03022 5B

Effects of Variation in Streamside Habitats on the Composition of Mountain Salamander Communities,
W87-03082 2H

Geochemistry of Tin in Rivers and Estuaries,
W87-03140 5B

Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships.
W87-03272 5B

Dissolved Loads of Rivers: A Global Overview,
W87-03273 5B

Dissolved Loads in Streams and Rivers - Discharged and Seasonally Related Variations,
W87-03279 5B

Multivariate Analysis of Quality Parameters to Determine the Chemical Transport in Rivers,
W87-03280 5B

Factors Controlling the Chemical Composition of River Waters of India,
W87-03285 2E

Atmospheric Inputs and River Transport of Dissolved Substances,
W87-03287 2B

Biogeochemical Controls on River Water Quality in a Forested Drainage Basin, Warwickshire, UK,
W87-03292 2E

Different Techniques for the Computation of River Nutrient Loads (Methodologies de Quantification des Flux de Nutriments en Riviere),
W87-03298 2H

RNA
Genomic Analysis of RNA Viruses Isolated from Water,
W87-02645 5A

ROCK BURST ZONE
Use of Grouting When Driving Through the Rock Burst Zone in the Dangara Irrigation Tunnel,
W87-03181 8E

ROCK TESTING
Analysis of Methods of Determining the Compressive Strength of Rocks,
W87-03180 8E

ROCKFALLS
Rockfall-Induced Waves in Reservoirs,
W87-03037 8E

ROCKS
Analysis of Methods of Determining the Compressive Strength of Rocks,
W87-03180 8E

Tunnels: Machine Excavation - Rate of Progress - Machine Data,
W87-03320 8A

ROCKY MOUNTAINS
Watershed Modeling for Fire Management Planning in the Northern Rocky Mountains,
W87-03323 4D

ROLLER-COMPACTED CONCRETE
RCC: A Dam Rehab Solution Unearthed,
W87-02770 8F

ROOFTOP COLLECTION SYSTEMS
Lessons from Field Experience with Rainwater Collection Systems in Africa and Asia,
W87-03042 5F

ROOT DISTRIBUTION
Root Distribution and Water Uptake Patterns of Maize Cultivars Field-Grown under Differential Irrigation,
W87-02817 2I

ROOTS
Alcohol Dehydrogenase Activity in the Roots of Marsh Plants in Naturally Waterlogged Soils,
W87-02816 2I

Root Systems in Relation to Stress Tolerance,
W87-02961 2I

Soil Compaction and Moisture Stress Preconditioning in Kentucky Bluegrass. I. Soil Aeration, Water Use, and Root Responses,
W87-02982 2G

Root Control of Leaf Phosphorus and Chlorine Accumulation in Soybean Under Salinity Stress,
W87-02984 2I

Responses of Sugarbeet to Deficit, High-Frequency Sprinkler Irrigation. I. Sucrose Accumulation, and Top and Root Dry Matter Production,
W87-02985 3F

Responses of Sugarbeet to Deficit, High-Frequency Sprinkler Irrigation. II. Sugarbeet Development and Partitioning to Root Growth,
W87-02986 3F

Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-03010 2I

Distribution and Standing Crop of Living and Dead Roots in Three Wetland Carex Species,
W87-03204 2H

ROOTS ZONE
Resistance of Plant Roots to Water Loss,
W87-03005 2I

ROOTSTOCKS
Effect of Rootstock on Apple (Malus domestica) Tree Water Relations,
W87-03056 2I

ROTAVIRUS
Detection of Rotavirus in Treated Drinking Water,
W87-02643 5B

ROTAVIRUSES
Rotavirus Survival in Raw and Treated Waters and Its Health Implications,
W87-02644 5G

Development of a Method for Concentration of Rotavirus and Its Application to Recovery of Rotaviruses from Estuarine Waters,
W87-02896 5A

ROUTE SENSING
Real-Time Kinematic Catchment Model for Hydro Operation,
W87-02766 2E

RUNOFF
Recycling Irrigation Runoff on Container Ornamentals,
W87-02956 3F

Basin-wide Ecological Fate Model for Management of Chemicals Hazard,
W87-02975 5B

Changes in Catchment Runoff Following Drainage and Afforestation,
W87-03072 4C

Nonpoint Source Loading of Phenolic Acids from Decomposing Crop Residue,
W87-03161 5B

Runoff Processes and Dissolved Substances During Flood Events in Small Differently Used Drainage Areas,
W87-03283 2E

RUNOFF CONTROL
Management of Instream Flows through Runoff Detention and Retention,
W87-02934 4A

RUNOFF DETENTION
Management of Instream Flows through Runoff Detention and Retention,
W87-02934 4A

RUNOFF DISTRIBUTION
Modeling North Cascades Annual Runoff Distribution Using Drainage Basin Elevation Distribution,
W87-02627 2E

RUNOFF FORECASTING
Modeling North Cascades Annual Runoff Distribution Using Drainage Basin Elevation Distribution,
W87-02627 2E

RUNOFF PLOT
Physiogenic and Anthropogenic Controls of Global and Regional Ionic Runoff,
W87-03275 2E

RUNOFF RATES
Review of Field Observations of Runoff Generation in the Tropics,
W87-02675 2E

RURAL AREAS
Study of Acid Deposition in Switzerland: Temporal Variation in the Ionic Composition of Wet Precipitation at Rural Sites During 1983-1984,
W87-02763 5B

RYEGRASS
Influence of Climatic Factors and Forage Age on the Chemical Components of Ryegrass Related to Grass Tetany,
W87-02980 2I

Relationships Between Growth and Measured Weather Factors Among Contrasting Varieties of Lolium, Dactylis and Festuca Species,
W87-03100 2I

SABARMATI RIVER
Trend Analysis of Water Quality in the Sabarmati River at Ahmedabad for a Decade (1969-1978),
W87-03278 5G

SAFE DRINKING WATER ACT
Safe Drinking Water Act,
W87-03122 6E

SAFETY
Self-closing Cylindrical Gate Improves Safety at Low Cost,
W87-02693 8C

SAINT VENANT EQUATIONS
Analytical and Numerical Solution of Saint-Venant Equations,
W87-03067 2E

SALAMANDERS
Effects of Variation in Streamside Habitats on the Composition of Mountain Salamander Communities,
W87-03082 2H

SALICORNIA BRACHIATA
Effects of Seawater on Amino Acids and Mineral Ions Composition in Salicornia brachiata Roxb,
W87-03093 3C

SALINAS VALLEY
Efficient Response Matrix Method for Coupling a Groundwater Simulator and a Regional Agricultural Management Model,
W87-02936 4B

SALINE-FRESHWATER INTERFACES
Simple Approximation for a Moving Interface in a Coastal Aquifer,
W87-02851 2F

Comparison of the Coupled Fresh Water-Salt Water Flow and the Ghyben-Herzberg Sharp Interface Approaches to Modeling of Transient Behavior in Coastal Aquifer Systems,
W87-03077 2F

Location of an Interface Observation Well: A Bayesian Approach,
W87-03187 2F

SALINE GROUNDWATER
Morphology of a Saline Groundwater Body: Its Investigation, Description and Possible Explanation,
W87-02849 2F

SALINE SOILS
Spatial Variability and Soil Sampling for Salinity and Sodicity Appraisal in Surface Irrigated Orchards,
W87-02726 2G

Effect of High Sulfate Irrigation Waters on Soil Salinity and Yields,
W87-02996 3C

SALINE WATER
Morphology of a Saline Groundwater Body: Its Investigation, Description and Possible Explanation,
W87-02849 2F

Saline- versus Freshwater Contribution to the Thermal Waters of the Northern Jordan Rift Valley, Israel,
W87-02852 2F

Irrigation Interval as a Factor in Sweet Corn Response to Salinity,
W87-03003 3C

SALINE WATER INTRUSION
Location of an Interface Observation Well: A Bayesian Approach,
W87-03187 2F

SALINITY
Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: I. Salinity During Growth Modulates the Proton Pump in the Halophyte Atriplex Nummularia,
W87-02717 2I

Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: II. K(+) Strongly Promotes Development of Membrane Potential in Vesicles from Cotton Roots,
W87-02718 2I

Spatial Variability and Soil Sampling for Salinity and Sodicity Appraisal in Surface Irrigated Orchards,
W87-02726 2G

Salt Tolerance in the Triticeae: Salinity-Induced Changes in the Leaf Solute Composition of Some Perennial Triticeae,
W87-02785 2I

Effects of Temperature, Salinity, Irradiance and Diurnal Periodicity on Growth and Photosynthesis in the Diatom Nitzschia americana: Light-Saturated Growth,
W87-02807 2L

Salinity Tolerance of Winged Bean as Compared With That of Soybean,
W87-02988 3C

Responses of Lettuce to Salinity. I. Effects of NaCl and Na2SO4 on Growth,
W87-03154 5C

SALINITY STRESS
Root Control of Leaf Phosphorus and Chlorine Accumulation in Soybean Under Salinity Stress,
W87-02984 2I

SALMON
Review and Analysis of Methods for Quantifying Instream Flow Requirements,
W87-02933 6D

SALMONELLA
Growth of Salmonellas in Different Enrichment Media,
W87-02786 5A

Salmonellae and Pollution Indicator Bacteria in Municipal and Food Processing Effluents and the Cornwallis River,
W87-02815 5D

SALT
Characterization and Classification of Seaside-Salt-marsh Soils on Virginia's Eastern Shore,
W87-02919 2L

Pollutants Associated with Sand and Salt Applied to Roads in Minnesota,
W87-02943 5B

SALT MARSHES
Characterization and Classification of Seaside-Salt-marsh Soils on Virginia's Eastern Shore,
W87-02919 2L

Biomass and Structure of a Spartina alterniflora Loisel.-dominated Salt Marsh in France,
W87-03203 2L

SALT STRESS
Ammonium (15N) Metabolism in Cotton Under Salt Stress,
W87-03151 5C

Responses of Lettuce to Salinity. I. Effects of NaCl and Na2SO4 on Growth,
W87-03154 5C

Contrasting Response to Salt Stress of Two Salinity Tolerant Creeping Bentgrass Clones,
W87-03156 5C

Water or Salt Stress Increases Infectivity of Erysiphe pisi Conidia Taken from Stressed Plants,
W87-03175 5C

SALT TOLERANCE
Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: I. Salinity During Growth Modulates the Proton Pump in the Halophyte Atriplex Nummularia,
W87-02717 2I

Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: II. K(+) Strongly Promotes Development of Membrane Potential in Vesicles from Cotton Roots,
W87-02718 2I

Salt Tolerance in the Triticeae: Salinity-Induced Changes in the Leaf Solute Composition of Some Perennial Triticeae,
W87-02785 2I

Effects of Temperature, Salinity, Irradiance and Diurnal Periodicity on Growth and Photosynthesis in the Diatom Nitzschia americana: Light-Saturated Growth,
W87-02807 2L

Salinity Tolerance of Winged Bean as Compared With That of Soybean,
W87-02988 3C

Potassium Utilization and Fluxes in Wild Salt-Tolerant Relatives of the Cultivated Tomato,
W87-03055 2I

Salt Responses of Lettuce to Salinity. II. Effect of Calcium on Growth and Mineral Status,
W87-03155 5C

Contrasting Response to Salt Stress of Two Salinity Tolerant Creeping Bentgrass Clones,
W87-03156 5C

SALTS
Influence of Soil Structure on Movement Rate of Salts Through Soils,
W87-02716 5B

Effects of Seawater on Amino Acids and Mineral Ions Composition in Salicornia brachiata Roxb,
W87-03093 3C

Construction of Dams on Soils Containing Soluble Salts,
W87-03186 8E

SAMPLE PREPARATION
Detection of Hepatitis A Virus (HAV) in Drinking Water,
W87-02646 5A

Detection of Hepatitis A Virus in Drinking Water by Enzyme-Immunoassay Using Ultracentrifugation for Virus Concentration,
W87-02647 5A

Concentration of Seeded and Naturally Occurring Enteroviruses from Waters of Varying Quality by Hollow Fiber Ultrafiltration,
W87-02648 5A

Recovery of Viruses from Drinking-Water by Means of an In-Line Electropositive Cartridge Filter,
W87-02649 5A

Concentration of Viruses from Water Using Pig Erythrocyte Ghost Cells,
W87-02650 5A

Automated Prevalve Dilution in Flow-Injection Analysis: The Automated Determination of Chloride in Surface, Ground and Domestic Water,
W87-02793 5A

Multielement Trace Preconcentration from Water on Activated Carbon for the Sample Pretreatment for Atomic Spectroscopy (Flame-AAS, ICP/OES), (Multielement-Spurenanreicherung aus Wassern an Aktivkohle zur Probenvorbereitung fur die Atomspektroskopie (Flammen-AAS, ICP/OES)),
W87-02799 5A

Selective Preconcentration of Copper from Aqueous Solution by Using Kerateine Gel,
W87-02802 5A

Investigations on the Application of the Ion-Exchanger SRAFION NMRR for the Enrichment and Separation of Uranium and Other Trace Elements from Sea Water, (Untersuchungen uber die Verwendbarkeit des Ionenaustauschers SRAFION NMRR zur Anreicherung und Abtrennung von Uran und anderen Spurenelementen aus dem Meerwasser),
W87-02803 5A

Determination of Acrylic Acid in Aqueous Samples by Electron Capture Gas Chromatography after Extraction with Tri-n-octylphosphine Oxide and Derivatization with Pentafluorobenzyl Bromide,
W87-02818 5A

Evaluation of Methods for Preservation of Water Samples for Nutrient Analysis,
W87-03030 5A

Indirect Atomic Absorption Determination of Anionic Surfactants in Wastewaters by Flow Injection Continuous Liquid-Liquid Extraction,
W87-03048 5A

Spectrophotometric Determination of Chromium in Waste Water and Soil,
W87-03052 5A

Liquid Chromatographic Determination of Fluridone Aquatic Herbicide and Its Metabolite in Fish and Crayfish,
W87-03113 5A

Fluorometric Determination of Nitrite in Natural Waters with 3-Aminonaphthalene-1,5-disulphonic Acid by Flow-Injection Analysis,
W87-03172 5A

Determination of Organically-associated Trace Metals in Estuarine Sea-Water by Solvent Extraction and Atomic-Absorption Spectrometry,
W87-03173 5A

SAMPLE PRESERVATION
Preservation of Traces of Chromium(VI) in Water and Waste Water Samples,
W87-02804 5A

SAMPLING
Spatial Variability and Soil Sampling for Salinity and Sodicity Appraisal in Surface Irrigated Orchards,
W87-02726 2G

Investigations on the Application of the Ion-Exchanger SRAFION NMRR for the Enrichment and Separation of Uranium and Other Trace Elements from Sea Water, (Untersuchungen uber die Verwendbarkeit des Ionenaustauschers SRAFION NMRR zur Anreicherung und Abtrennung von Uran und anderen Spurenelementen aus dem Meerwasser),
W87-02803 5A

Measuring Suspended Sediment in Small Mountain Streams,
W87-03324 5A

SAND
Pollutants Associated with Sand and Salt Applied to Roads in Minnesota,
W87-02943 5B

SAND FILTERS
Slow Sand Filtration: Influences of Selected Process Variables,
W87-02611 5F

Dual-use Filters Keep Wet-weather Flows Under Control,
W87-02926 5D

SANDY SOILS
Corn Irrigation Scheduling in Humid Regions on Sandy Soils with Tillage Pans,
W87-02981 3F

SANITARY ENGINEERING
Computerized Layout Generation for Sanitary Sewers,
W87-03062 8A

Planning and Technology in Sanitary and Environmental Engineering,
W87-03098 6A

SANITATION
Sanitary Study of Surface Water and of the Beach of a Water Sports and Leisure Complex,
W87-02777 5B

Wastewater Treatment by Soil,
W87-03264 5D

SAPANCA LAKE
Determination of Pollution and Eutrophic Conditions of Sapanca Lake (Turkey),
W87-02587 5B

SATURATED FLOW
Finite-Element Collocation Method for Variably Saturated Flow in Two Space Dimensions,
W87-03192 2F

SATURATED SOIL
Examination of the Penetration of Enteric Viruses in Soils under Simulated Conditions in the Laboratory,
W87-02663 5B

SATURATED SOILS
Water Sorption Characteristics of Aluminum- and Calcium-Saturated Soil Clays,
W87-02728 2G

Effect of Cultivated and Wild Rice Varieties on the Nitrogen Balance of Flooded Soil,
W87-02813 2I

Alcohol Dehydrogenase Activity in the Roots of Marsh Plants in Naturally Waterlogged Soils,
W87-02816 2I

Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-03009 2I

SATURATED ZONE
High Concentration of Solutes at the Upper Part of the Saturated Zone (Water Table) of a Deep Aquifer Under Sewage-Irrigated Land,
W87-02677 2F

SAUDI ARABIA
Need for Fluoridation of Desalinated Water Supplies,
W87-03041 5F

SAULT-BRENAZ
Energy Recovery Small Hydro Plants on the Rhone River. The First Months of Operation of Champagneux Power Plant and the Sault-Brenaz Project, (Les Petites Centrales de Recuperation sur le Rhone. Les Premiers Mois d' Exploitation de la Centrale de Champagneux et le Project de Sault-Brenaz),
W87-02575 8C

SAVA RIVER
Regime of Ground Water of Semberian Aquifer,
W87-03043 2F

SCHEDULING
Models for Water and Power Scheduling for the California State Water Project,
W87-02626 6A

SCHEFFLERA ARBORICOLA
Effect of Short-term Water Stress on Leaf Gas Exchange Processes and Plant Water Potential in Schefflera,
W87-03104 2I

SCREENS
Passive Screen Water Intake Design Studies,
W87-02767 8I

SEA WATER
Investigations on the Application of the Ion-Exchanger SRAFION NMRR for the Enrichment and Separation of Uranium and Other Trace Elements from Sea Water, (Untersuchungen uber die Verwendbarkeit des Ionenaustauschers SRAFION NMRR zur Anreicherung und Abtrennung von Uran und anderen Spurenelementen aus dem Meerwasser),
W87-02803 5A

SEASONAL VARIATION
Seasonal Sediment Yield to Mark Twain Lake, Missouri,
W87-02789 2J

Nutrient and Trace Metal Fluxes in the Magela Creek System, Northern Australia,
W87-02974 2E

Zooplankton Fauna of Killary Harbour: The Seasonal Cycle of Abundance,
W87-03054 2L

Seasonal Growth and Composition and Accumulation of N-P-K in Dryland and Irrigated Pumpkins,
W87-03150 2I

Biogeochemical Controls on River Water Quality in a Forested Drainage Basin, Warwickshire, UK,
W87-03292 2E

SEASONAL VARIATIONS
Association Between Some Planktonic Species and Physicochemical Characteristics of the Water of Loktak Lake, Manipur, India,
W87-03025 2H

SEAWATER
Effect of Seawater on Nitrification by Attached Biofilm,
W87-02603 5D

Seawater Induced Algal Flocculation,
W87-02703 5D

Effects of Seawater on Amino Acids and Mineral Ions Composition in Salicornia brachiata Roxb,
W87-03093 3C

Fluorometric Determination of Nitrite in Natural Waters with 3-Aminonaphthalene-1,5-disulphonic Acid by Flow-Injection Analysis,
W87-03172 5A

SECONDARY WASTEWATER
Microbial Polymers in the Aquatic Environment-II: Isolation from Biologically Non-purified and Purified Municipal Waste Water and Analysis,
W87-02695 5D

Problems of Using Wastewater on Vegetable Crops,
W87-02954 3C

SEDIMENT BUDGETS
Nutrient and Sediment Budgets for the Tidal Potomac River and Estuary,
W87-03290 5B

SEDIMENT CONTAMINATION
Management of Bottom Sediments Containing Toxic Substances.
W87-03248 5G

Ecological Evaluation of Organotin-Contaminated Sediment,
W87-03254 5B

Characterization of Sediment Contamination Utilizing Bioassay/Bioaccumulation Testing,
W87-03255 5B

Identification of Promising Concepts for Treatment of Contaminated Sediments,
W87-03256 5D

Influence of Accumulating Organic Sediment on the Marine Environment in Osaka Bay,
W87-03257 5C

SEDIMENT DISCHARGE
Historic Trends in the Sediment Flow Regime of the Mississippi River,
W87-03195 2J

SEDIMENT DISTRIBUTION
Forecasting Sediment Distribution in Reservoirs During Unstable Conditions,
W87-02680 2J

SEDIMENT LOAD
Measuring Suspended Sediment in Small Mountain Streams,
W87-03324 5A

SEDIMENT SAMPLES
Controlling Suspended Sediment Samplers by Programmable Calculator and Interface Circuitry,
W87-03337 7B

SEDIMENT TRANSPORT
Transport of Gravel by Flows up to 500 cu m/s, Ohau River, Otago, New Zealand,
W87-02773 2J

Historic Trends in the Sediment Flow Regime of the Mississippi River,
W87-03195 2J

SEDIMENT-WATER INTERFACE
Review of the Role of Bed Deposits in the Phosphate Eutrophication of Lakes and Rivers,
W87-03022 5B

SEDIMENT-WATER INTERFACES
Effect of Oxygen on Release and Uptake of Cobalt, Manganese, Iron and Phosphate at the Sediment-Water Interface,
W87-03143 5B

Study on Chemical Behavior Between Sediment and Upper Water,
W87-03251 2J

SEDIMENT YIELD
Seasonal Sediment Yield to Mark Twain Lake, Missouri,
W87-02789 2J

SEDIMENTARY BASINS
Examination of the Mechanisms Controlling Groundwater Gradients in Hyper-Arid Regional Sedimentary Basins,
W87-02942 2F

SEDIMENTATION
Transport of Gravel by Flows up to 500 cu m/s, Ohau River, Otago, New Zealand,
W87-02773 2J

Seasonal Sediment Yield to Mark Twain Lake, Missouri,
W87-02789 2J

Crater Lake, Oregon: A Restricted Basin with Base-of-Slope Aprons of Nonchannelized Turbidites,
W87-03220 2J

Results of Sedimentation and Elutriate Tests from Osaka Bay Sediment,
W87-03258 2J

Partial Review of Dredged Material Disposal Techniques,
W87-03259 5E

SEDIMENTS
Overview of PCB Pollution and its Behavior in Seine River, (Apercu sur la Pollution par les P.C.B. (Polychlorobiphenyles) en Seine, et son Comportement),
W87-02564 5B

Control of the Methylation Process in a Mercury-polluted Aquatic Sediment,
W87-02584 5B

Design Factors for the Scouring of Deposited Materials in Water and Wastewater Treatment Systems,
W87-02674 5F

Forecasting Sediment Distribution in Reservoirs During Unstable Conditions,
W87-02680 2J

Anomalous Binding of Organic Contaminants May Be Artifactual Due to Radiochemical Impurities,
W87-02700 5A

Human Viruses in Sediments, Sludges, and Soils,
W87-02768 5B

Studies on Sediments of the River Lahn: 2. Chemometric Evaluation, (Untersuchungen an Lahnsedimenten: 2. Chemometrische Auswertung),
W87-02801 5B

Study on the Modelling of the Behavior of Phosphorus Released from Sediments,
W87-02967 2L

Numerical Prediction on the Effect of Phosphorus Release Control by Sediment Dredging,
W87-03253 5B

SEED TREATMENT
Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-03009 2I

SEEDLINGS
Effects of Pattern and Amount of Simulated Rainfall on Seedling Dynamics of Weeping Lovegrass and Kleingrass,
W87-03011 2I

Growth and Nutritional Status of Petunia and Tomato Seedlings with Acidified Irrigation Water,
W87-03105 5C

SEEDS
Herbicides and Seeding Rate Effects on Sprinkler-Irrigated Rice,
W87-03013 2I

SEEPAGE PITS
Geochemical and Environmental Processes Affecting Radionuclide Migration from a Formerly Used Seepage Trench,
W87-03135 5E

SEGMENTED MODELS
Box Model for Prediction of Water Quality in Eutrophic Lakes,
W87-02972 2H

SEINE RIVER
Overview of PCB Pollution and its Behavior in Seine River, (Apercu sur la Pollution par les P.C.B. (Polychlorobiphenyles) en Seine, et son Comportement),
W87-02564 5B

SELECT
SELECT: The Numerical Model,
W87-03235 5G

SELECTIVE WITHDRAWAL
Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures.
W87-03221 8A

Selective Withdrawal: Basic Concepts,
W87-03222 8B

Hydraulic Design of the Selective Withdrawal Structures of the Lost Creek Dam,
W87-03223 8A

Hydraulic Design of the Selective Withdrawal Structures of the Applegate Dam,
W87-03224 8A

Hydraulic Design of the Selective Withdrawal Structures at the Elk Creek Dam,
W87-03225 8A

Reservoir Regulation and Selective Withdrawal in Oregon,
W87-03226 6D

Operation of Selective Withdrawal Facilities: Libby Dam, Montana,
W87-03227 5C

Alternatives for Improving Reservoir Water Quality,
W87-03228 5G

Review of Selective Withdrawal Performance in the Fort Worth District,
W87-03229 6B

Modeling of Selective Withdrawal Intake Structures,
W87-03230 5G

Bloomington Dam, Potomac River Water Quality Outlet,
W87-03231 5G

Hydraulic Design: Bloomington Lake and F. E. Walter Dam Project's Selective Withdrawal Structures,
W87-03233 8A

Determination of Selective Withdrawal System Capacity for Intake Tower Design,
W87-03234 5G

SELECT: The Numerical Model,
W87-03235 5G

Design of Selective Withdrawal Intake Structures,
W87-03237 8A

Operational Tools: Selective Withdrawal and Daily Operational Strategy,
W87-03238 5G

Operational Tools: Optimal Control of Reservoir Water Quality,
W87-03239 5G

Thoughts and Considerations for Hydraulic Design,
W87-03241 8B

Selective Withdrawal Needs for Lake Greeson Arkansas Intake Structure,
W87-03242 5G

Selective Withdrawal Structure Operation Experiences in ORD,
W87-03243 8A

Overview of Pittsburgh District Selective Withdrawal Operation Experiences,
W87-03244 5G

Selective Withdrawal From Any Level Between Minimum Pool and Spillway Elevation at Stonewall Jackson Dam, West Virginia,
W87-03245 8A

Selective Experiences: Alias Withdrawal Pains,
W87-03246 6B

Design and Performance of Skimming Weirs in the Kansas City District,
W87-03247 8A

SELENASTRUM
Toxicity of Brass Dust to the Microalgae Ankistrodesmus falcatus and Selenastrum capricornutum,
W87-02778 5C

SEMBERIAN AQUIFER
Regime of Ground Water of Semberian Aquifer,
W87-03043 2F

SENSITIVITY ANALYSIS
Unsaturated Flow Through Solid Waste Landfills: Model and Sensitivity Analysis,
W87-02628 5B

SENSORS
Cordless Geo-Data Link,
W87-03031 7B

SEOUL
Water Use in Urban Korea,
W87-02617 6D

SEPARATION
Investigations on the Application of the Ion-Exchanger SRAFION NMRR for the Enrichment and Separation of Uranium and Other Trace Elements from Sea Water, (Untersuchungen uber die Verwendbarkeit des Ionenaustauschers SRAFION NMRR zur Anreicherung und Abtrennung von Uran und anderen Spurenelementen aus dem Meerwasser),
W87-02803 5A

SEPTIC SLUDGE
Manurial Value of Septic-Tank Sludge on Grassland,
W87-03102 5E

SEPTIC TANKS
Effect of Soil and Effluent Characteristics on Phosphorus Sorption in Dosed Columns,
W87-02861 2G

Use of Geostatistics to Predict Virus Decay Rates for Determination of Septic Tank Setback Distances,
W87-02895 5B

Wastewater Engineering Design for Unsewered Areas,
W87-03339 5E

SETO INLAND SEA
Modelling of the Lower Trophic Levels of a Marine Ecosystem and Its Example of Short-period Variations of Chlorophyll and Nutrient in Harima-Nada,
W87-02601 2L

Determination of Organically-associated Trace Metals in Estuarine Sea-Water by Solvent Extraction and Atomic-Absorption Spectrometry,
W87-03173 5A

SETTLING BASINS
Water Supply of Varanasi - The Oldest City of India,
W87-03039 5F

SEVERN BARRAGE
Time and Tide Are Right for the Severn Barrage,
W87-03091 8A

SEVERN ESTUARY
Seasonal Abundance, Growth, Feeding and Age Composition of Flounder (Platichthys flesus (L.)) Populations of the Severn Estuary and Bristol Channel,
W87-03027 2L

SEWER OVERFLOW
Characterization of Water Using Combined Sewer Overflows, (Caracterization des Eaux Usees de Debordements de Reseau Unitaire),
W87-02672 5B

SEWER SYSTEMS
Computerized Layout Generation for Sanitary Sewers,
W87-03062 8A

SHALLOW WATER
Experiments on Vertical Plane Buoyant Jets in Shallow Water,
W87-02762 8B

Spectral and Statistical Characteristics of Shallow Water Waves,
W87-03218 8B

SHELLFISH
Chione (Austrovenus) stutchburyi, a New Zealand Cockle, as a Bio-indicator for Lead Pollution,
W87-02586 5A

SILICA
Alkali-Silica Reactivity in Five Dams in Southwestern United States,
W87-03319 8F

SILTATION
Time and Tide Are Right for the Severn Barrage,
W87-03091 8A

SIMULATED RAINFALL
Effects of Pattern and Amount of Simulated Rainfall on Seedling Dynamics of Weeping Lovegrass and Kleingrass,
W87-03011 2I

Department of Agriculture, Belfast (N. Ireland). Agricultural and Food Chemistry Research Div.
W87-03159 3F

Rates of Mineral Element Leaching from Leaves of Nine Plant Species from a Southern Appalachian Forest Succession Subjected to Simulated Acid Rain,
W87-03206 5C

SIMULATION
Interactive Algorithm for the Parameter Estimation of Complex Systems and Its Application to an Ecological Modelling of an Actual Japanese Lake,
W87-02600 2H

Model Simulation of Solute Leaching and Its Application for Estimating the Net Rate of Nitrate Formation under Field Conditions,
W87-02839 5B

SIMULATION ANALYSIS
Determination of Rainfall Excess on Spatially Variable Catchments,
W87-02853 2A

New Analogue Computer for the Study of Pumping Tests under Falling Water-Table Conditions,
W87-02854 7B

Procedure to Identify Different Groups of Hydraulic-Conductivity and Moisture-Retention Curves for Soil Horizons,
W87-03075 2G

Numerical Simulation Relating Land Uses Within a Drainage Basin to the Downstream River Water Quality (Simulation Numerique de l'Influence des Pratiques Culturales dans un BAsin Versant sur la Qualite des Eaux a Son Exutoire),
W87-03300 6G

SIMULATION ANALYSIS RIGID FOUNDATIONS
Development of a Collision Tolerant Pile Structure Concept,
W87-03219 8A

SIMULATION MODELS
Modelling of Industrial Ecological Systems for Evaluation of Health Services,
W87-02979 4C

SIMULATIONS
Delay of Reaction Turbines and Pumps to Transient States, (Retard des Turbines a Reaction et des Pompes dans Leur Comportement en Regime Transitoire),
W87-02581 8C

SINGLE-AGAR-LAYER METHOD
Practical Direct Plaque Assay for Coliphages in 100-ml Samples of Drinking Water,
W87-02890 5A

SINGLE-SLUDGE SYSTEM
Single-sludge Nitrogen Removal: Modeling and Experimental Results,
W87-02823 5D

SIPHON EFFECT
Small Hydroelectric Power Plants for Very Low Heads, (Les Usines de Tres Basse Chute en Mini-Hydroelectricite),
W87-02571 8C

SIPHONS
Adaptation of an Existing Sill for Installation of a Siphon Plant, (Adaptation d'un Seuil Existant pour l'Implantation d'un Groupe en Siphon), W87-02574 8C

SLACK TIDE
Slack Tide Oxygen Balance Model, W87-02889 5B

SLOPE DEGRADATION
Groundwater Seepage Vectors and the Potential for Hillslope Failure and Debris Flow Mobilization, W87-03193 2F

SLOPE STABILITY
Rockfall-Induced Waves in Reservoirs, W87-03037 8E

Riprap Stability and Navigation Tests for the Divide-Cut Section Tennessee-Tombigbee Waterway, W87-03317 8A

SLUDGE
Bacteria and Viruses in Aerobically Digested Sludge: Influence of Physical and Chemical Treatments on Survival and Association with Flocs under Laboratory Conditions, W87-02660 5D

Detection and Stability of Enteric Viruses in Sludge, Soil and Ground Water, W87-02662 5B

New Strategies for the Isolation of Microorganisms Responsible for Phosphate Accumulation, W87-02740 5D

Exchange of Organics, Phosphate and Cations between Sludge and Water in Biological Phosphorus and Nitrogen Removal Processes, W87-02745 5D

Phosphorus Removal at Low Sludge Loadings, W87-02747 5D

Nitrilotriacetic Acid in Sludge-amended Soil: Mobility and Effects on Metal Solubility, W87-02765 5E

Human Viruses in Sediments, Sludges, and Soils, W87-02768 5B

Measuring Sludge Concentration and Quality, W87-02835 5D

Impact of Chemically Contaminated Sewage Sludge on the Collard Arthropod Community, W87-03081 5C

SLUDGE DIGESTION
Virus Inactivating Effect of Anaerobic Mesophilic Digestion of Municipal Sludge With or Without Different Preceding Types of Treatment, W87-02661 5D

Fundamentals of Anaerobic Digestion of Wastewater Sludges, W87-02884 5D

Method for Determining Virus Inactivation During Sludge Treatment Processes, W87-02898 5A

SLUDGE DISPOSAL
Finding Uses for Sludge, W87-02641 5E

Improved Method for Recovery of Enteric Viruses from Wastewater Sludges, W87-02710 5A

Correlation of Metal-Organic Fractions with Soil Properties in Sewage-Sludge-Amended Soils, W87-02714 5E

Model Simulation of Solute Leaching and Its Application for Estimating the Net Rate of Nitrate Formation under Field Conditions, W87-02839 5B

SLUDGE DRYING
Dewatering of Bottom Sediments, W87-03261 2J

SLUDGE UTILIZATION
Finding Uses for Sludge, W87-02641 5E

Correlation of Metal-Organic Fractions with Soil Properties in Sewage-Sludge-Amended Soils, W87-02714 5E

Response of Lettuce Cultivars to Sludge-Amended Soils and Bed Types, W87-02880 3C

Manurial Value of Septic-Tank Sludge on Grassland, W87-03102 5E

SMALL STREAMS
Morphological Features of Small Streams: Significance and Function, W87-02931 4A

SNOAP MODELS
Diel Variation of In-stream Nitrification, W87-02711 5B

SNOW
Snow Loads in the 1985 National Building Code of Canada: Curved Roofs, W87-02667 2C

SNOW ACCUMULATION
Estimating Snow Load in California for Three Recurrence Intervals, W87-03336 2C

SNOW COVER
Effect of Standing Small Grain Stubble on Snow Cover Characteristics in Alternate Fallow Strip Cropping, W87-02990 2C

SNOW LOAD
Estimating Snow Load in California for Three Recurrence Intervals, W87-03336 2C

SNOW MANAGEMENT
Snow and Fertilizer Management for Continuous Zero-Till Spring Wheat, W87-02879 3F

SNOW REMOVAL
When Snow Falls in a Small Town, W87-02640 2C

SNOWFALL
When Snow Falls in a Small Town, W87-02640 2C

SNOWMELT
Pollutants Associated with Sand and Salt Applied to Roads in Minnesota, W87-02943 5B

SNOWPACK
Deposition of Atmospheric Trace Metals in Northern Sweden as Measured in the Snowpack, W87-02720 5B

SOCIAL IMPACT
Supplemental Class III Archaeological Survey of the Phase A, Reach 3 Corridor, Tucson Aqueduct, Central Arizona Project: Late Sedentary and Early Classic Period Tucson Basin Hohokam Occupation in the Lower Santa Cruz Basin, Marana to Rillito, Arizona, W87-03329 6G

SOCIAL IMPACTS
Research Design for Tucson Aqueduct, Phase B Data Recovery, W87-03328 6G

SOCIOECONOMIC MODELS
Analysis and Cartographical Approach to the Regional Water Utilization System in the Yodo River Basin, W87-02978 6D

SODICITY
Spatial Variability and Soil Sampling for Salinity and Sodicity Appraisal in Surface Irrigated Orchards, W87-02726 2G

SODIUM BENTONITE
Innovative Lagoon Liner Pays Off, W87-03078 5D

SODIUM CHLORIDE
Responses of Lettuce to Salinity. I. Effects of NaCl and Na2SO4 on Growth, W87-03154 5C

SODIUM SULFATE
Responses of Lettuce to Salinity. I. Effects of NaCl and Na2SO4 on Growth, W87-03154 5C

SOIL AERATION
Air Encapsulation: I. Measurement in a Field Soil, W87-02915 2G

Soil Compaction and Moisture Stress Preconditioning in Kentucky Bluegrass. I. Soil Aeration, Water Use, and Root Responses, W87-02982 2G

SOIL AGGREGATES
Feasibility of Using Mycorrhizal Fungi for Enhancement of Plant Establishment on Dredged Material Disposal Sites: A Literature Review, W87-03316 3D

SOIL AMENDMENTS
Soil Application of a Hydrophilic Conditioner in Relation to Moisture, Irrigation Frequency and Crop Growth, W87-02881 3F

Feasibility of Using Mycorrhizal Fungi for Enhancement of Plant Establishment on Dredged Material Disposal Sites: A Literature Review, W87-03316 3D

SOIL ANALYSIS
Spectrophotometric Determination of Chromium in Waste Water and Soil, W87-03052 5A

Radionuclide Concentrations in Louisiana Soils and Sediments, W87-03085 5B

SOIL BACTERIA
R-Plasmid Transfer in Soil and Water, W87-02792 5C

SOIL CHEMISTRY
Spatial Variability and Soil Sampling for Salinity and Sodicity Appraisal in Surface Irrigated Orchards, W87-02726 2G

Studies on Sediments of the River Lahn: 1. Analytical Results, (Untersuchungen an Lahnsedimenten: 1. Analytische Ergebnisse), W87-02800 5B

Studies on Sediments of the River Lahn: 2. Chemometric Evaluation, (Untersuchungen an Lahnsedimenten: 2. Chemometrische Auswertung), W87-02801 5B

Vertical Transport and Fate of Low-Water-Solubility Chemicals in Unsaturated Soils,
W87-02836 5B

Fluridone Retention and Release in Soils,
W87-02918 5B

SOIL COLUMNS
Examination of the Penetration of Enteric Viruses in Soils under Simulated Conditions in the Laboratory,
W87-02663 5B

Effect of Soil and Effluent Characteristics on Phosphorus Sorption in Dosed Columns,
W87-02861 2G

SOIL COMPACTION
Method of Investigating the Compactibility of Cohesive Soils,
W87-02865 8D

Soil Compaction and Moisture Stress Preconditioning in Kentucky Bluegrass. I. Soil Aeration, Water Use, and Root Responses,
W87-02982 2G

Soil Compaction and Moisture Stress Preconditioning in Kentucky Bluegrass. II. Stomatal Resistance, Leaf Water Potential, and Canopy Temperature,
W87-02983 2G

Compaction, Hydrological Processes and Soil Erosion on Loamy Sands in East Shropshire, England,
W87-03160 2J

Compaction and Tillage Depth Combinations for Water Management and Rice Production in Low-Retentive Permeable Soils,
W87-03163 3F

Effects of Tillage Methods and Water Regimes on Soil Properties and Yield of Lowland Rice from a Sandy Loam Soil in Southwest Nigeria,
W87-03164 2I

SOIL CONDITIONERS
Effects of Soil Conditioners on Water Relationships in Soils,
W87-02910 2G

SOIL DISPOSAL FIELDS
Effect of Soil and Effluent Characteristics on Phosphorus Sorption in Dosed Columns,
W87-02861 2G

SOIL DRAINAGE
Response to Waterlogging and Differing Sensitivity to Divalent Iron and Manganese in Clones of Dactylis glomerata L. Derived from Well-Drained and Poorly-Drained Soils,
W87-03095 5C

SOIL ENGINEERING
Method of Investigating the Compactibility of Cohesive Soils,
W87-02865 8D

SOIL ENVIRONMENT
Human Viruses in Sediments, Sludges, and Soils,
W87-02768 5B

SOIL EROSION
Compaction, Hydrological Processes and Soil Erosion on Loamy Sands in East Shropshire, England,
W87-03160 2J

SOIL FUNGI
Feasibility of Using Mycorrhizal Fungi for Enhancement of Plant Establishment on Dredged Material Disposal Sites: A Literature Review,
W87-03316 3D

SOIL HORIZONS
Procedure to Identify Different Groups of Hydraulic-Conductivity and Moisture-Retention Curves for Soil Horizons,
W87-03075 2G

SOIL HYDROLOGY
Hydrology of a Sloping, Structured Clay Soil at Wytham, Near Oxford, England,
W87-02685 2G

SOIL MOISTURE RETENTION
Soil Application of a Hydrophilic Conditioner in Relation to Moisture, Irrigation Frequency and Crop Growth,
W87-02881 3F

Temperature Dependence of Soil Water Retention Curves,
W87-02914 2G

Soils Influence Irrigation,
W87-03020 2G

SOIL PERMEABILITY
Compaction and Tillage Depth Combinations for Water Management and Rice Production in Low-Retentive Permeable Soils,
W87-03163 3F

SOIL PHYSICAL PROPERTIES
Termination Criteria for Clay Permeability Testing,
W87-02788 2G

Graphic Plotting of the Relationships of Physical Characteristics of Soils,
W87-02871 8D

SOIL POROSITY
Termination Criteria for Clay Permeability Testing,
W87-02788 2G

Construction of Dams on Soils Containing Soluble Salts,
W87-03186 8E

SOIL POTENTIAL RATING
Soil Potential Ratings for Onsite Wastewater Disposal,
W87-02860 5E

SOIL PRESSURE
Observations of Spatial Variability of Soil-Water Pressure in a Field Soil,
W87-02713 2G

SOIL PROFILES
Profile Modification and Irrigation Effects on Yield and Water Use of Wheat,
W87-02920 3F

SOIL PROPERTIES
Hydrology of a Sloping, Structured Clay Soil at Wytham, Near Oxford, England,
W87-02685 2G

Correlation of Metal-Organic Fractions with Soil Properties in Sewage-Sludge-Amended Soils,
W87-02714 5E

Hydraulic Conductivity and Related Physical Properties of Peat, Lost River Peatland, Northern Minnesota,
W87-02715 2G

Immiscible Contaminant Transport in Soils and Groundwater with an Emphasis on Petroleum Hydrocarbons: System of Differential Equations vs Single Cell Model,
W87-02729 5B

Transport of Solutes in Soil: Basic Features of Front Retardation,
W87-02733 5B

Termination Criteria for Clay Permeability Testing,
W87-02788 2G

Soil Potential Ratings for Onsite Wastewater Disposal,
W87-02860 5E

Effect of Soil and Effluent Characteristics on Phosphorus Sorption in Dosed Columns,
W87-02861 2G

Method of Investigating the Compactibility of Cohesive Soils,
W87-02865 8D

Estimating Macroporosity in a Forest Watershed by use of a Tension Infiltrometer,
W87-02917 2G

Mechanized Tillage Systems Effects on Properties of a Tropical Alfisol in Watersheds Cropped to Maize,
W87-03162 2G

Effects of Tillage Methods and Water Regimes on Soil Properties and Yield of Lowland Rice from a Sandy Loam Soil in Southwest Nigeria,
W87-03164 2I

Two-Chamber Consolidation Press,
W87-03183 8D

SOIL SALINITY
Evaporation and Redistribution of Salts in a Silt Loam Soil as Affected by Tillage Induced Soil Mulch,
W87-03168 3F

SOIL SATURATION
Vertical-Horizontal Transport and Fate of Low Water Solubility Chemicals in Unsaturated Soils,
W87-03074 2G

SOIL SCIENCE
Examination of the Penetration of Enteric Viruses in Soils under Simulated Conditions in the Laboratory,
W87-02663 5B

Effect of Cultivated and Wild Rice Varieties on the Nitrogen Balance of Flooded Soil,
W87-02813 2I

Explicit Solution of the Modified Horton Equation,
W87-02850 2G

Soil Potential Ratings for Onsite Wastewater Disposal,
W87-02860 5E

SOIL STABILIZATION
Feasibility of Using Mycorrhizal Fungi for Enhancement of Plant Establishment on Dredged Material Disposal Sites: A Literature Review,
W87-03316 3D

SOIL STRUCTURE
Influence of Soil Structure on Movement Rate of Salts Through Soils,
W87-02716 5B

SOIL TEMPERATURE
Microclimate of an Upland Grassland,
W87-03101 2I

Effect of Tillage and Mulching on Soil Environment and Cowpea Seedling Growth Under Arid Conditions,
W87-03166 3F

SOIL TEXTURE
Estimating Generalized Soil-water Characteristics from Texture,
W87-02727 2G

SOIL TREATMENT
Wastewater Treatment by Soil,
W87-03264 5D

SOIL TYPES
Detection and Stability of Enteric Viruses in Sludge, Soil and Ground Water,
W87-02662 5B

Soils Influence Irrigation,
W87-03020 2G

SOIL WATER
Ion-Exchange Resin Samplers for the In-Site Measurement of Major Cations in Soilwater Solute Flux,
W87-02678 7B

Evaporation from the Understorey in the Jarrah (Eucalyptus Marginata Don Ex Sm.) Forest, Southwestern Australia,
W87-02679 2D

Soil-Water Determination Using Fiber Optics,
W87-02723 2G

Combined Effect of Hysteresis and Temperature on Soil-Water Movement,
W87-02857 2G

Distribution Function Approach to Water Flow in Soil Macropores Based on Kinematic Wave Theory,
W87-02858 2G

Soil Application of a Hydrophilic Conditioner in Relation to Moisture, Irrigation Frequency and Crop Growth,
W87-02881 3F

Effects of Soil Conditioners on Water Relationships in Soils,
W87-02910 2G

Transport and Loss of Nitrous Oxide in Soil Water After Forest Clear-cutting,
W87-02912 5B

Temperature Dependence of Soil Water Retention Curves,
W87-02914 2G

Goodness of Fit for Eight Water Infiltration Models,
W87-02923 2G

Wheat Residue Management Effects on Soil Water Storage and Corn Production,
W87-02924 3F

Methods of Inducing Water Stress in Plants,
W87-02951 2I

Soil Water Balance of Intercropped Maize and Cowpea Grown in a Tropical Hydromorphic Soil in Western Nigeria,
W87-02989 2I

Growth and Yield of Sunflower and Soybean Under Soil Water Deficits,
W87-02992 2I

Effects of Carbon Dioxide Enrichment and Soil Water on Maize,
W87-03002 2I

Procedure to Identify Different Groups of Hydraulic-Conductivity and Moisture-Retention Curves for Soil Horizons,
W87-03075 2G

Response to Waterlogging and Differing Sensitivity to Divalent Iron and Manganese in Clones of Dactylis glomerata L. Derived from Well-Drained and Poorly-Drained Soils,
W87-03095 5C

Microclimate of an Upland Grassland,
W87-03101 2I

Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. I. Soil Moisture, Water Relations, Tree and Fruit Growth,
W87-03110 3F

Forms of Nitrogen in Waterlogged Soils and Their Contribution to Yield and Nitrogen Uptake by Rice,
W87-03158 3C

Evaporation and Redistribution of Salts in a Silt Loam Soil as Affected by Tillage Induced Soil Mulch,
W87-03168 3F

Physical Environment Near the Surface of Plowed and No-Tilled Soils,
W87-03171 2G

SOIL WATER MOVEMENT
Algorithm for Computing the Relationship between Diffusivity and Soil Moisture Content from the Hot Air Method,
W87-02856 2G

Combined Effect of Hysteresis and Temperature on Soil-Water Movement,
W87-02857 2G

SOIL-WATER-PLANT RELATIONSHIPS
Effect of Cultivated and Wild Rice Varieties on the Nitrogen Balance of Flooded Soil,
W87-02813 2I

Alcohol Dehydrogenase Activity in the Roots of Marsh Plants in Naturally Waterlogged Soils,
W87-02816 2I

Root Distribution and Water Uptake Patterns of Maize Cultivars Field-Grown under Differential Irrigation,
W87-02817 2I

Effects of Soil Conditioners on Water Relationships in Soils,
W87-02910 2G

SOIL WATER POTENTIAL
Estimating Generalized Soil-water Characteristics from Texture,
W87-02727 2G

SOILWATER MOVEMENT
Preferential Flow and Hydraulic Conductivity of Forest Soils,
W87-02724 2G

SOLAR RADIATION
Microclimate of an Upland Grassland,
W87-03101 2I

SOLDER
Lead Dissolution From Soldered Joints,
W87-02607 5B

SOLUBILITY
Nitrilotriacetic Acid in Sludge-amended Soil: Mobility and Effects on Metal Solubility,
W87-02765 5E

Prediction of the Distribution Constant of some Solutes Containing Hydrophilic Functional Groups from Data on the Solubility of Water in Organic Solvents,
W87-02906 1B

Chemical Control of Soluble Phosphorus in the Amazon Estuary,
W87-03139 5B

Thermodynamic Study of Solutions of Liquid Hydrocarbon Mixtures in Water,
W87-03145 1B

Construction of Dams on Soils Containing Soluble Salts,
W87-03186 8E

SOLUBILTY
Vertical-Horizontal Transport and Fate of Low Water Solubility Chemicals in Unsaturated Soils,
W87-03074 2G

SOLUTE TRANSPORT
Generalization and Applications of Tracer Dispersion Data,
W87-02620 5B

Examination of the Penetration of Enteric Viruses in Soils under Simulated Conditions in the Laboratory,
W87-02663 5B

Ion-Exchange Resin Samplers for the In-Site Measurement of Major Cations in Soilwater Solute Flux,
W87-02678 7B

Influence of Soil Structure on Movement Rate of Salts Through Soils,
W87-02716 5B

Transport of Solutes in Soil: Basic Features of Front Retardation,
W87-02733 5B

Vertical Transport and Fate of Low-Water-Solubility Chemicals in Unsaturated Soils,
W87-02836 5B

Model Simulation of Solute Leaching and Its Application for Estimating the Net Rate of Nitrate Formation under Field Conditions,
W87-02839 5B

Effect of Soil and Effluent Characteristics on Phosphorus Sorption in Dosed Columns,
W87-02861 2G

Transport and Loss of Nitrous Oxide in Soil Water After Forest Clear-cutting,
W87-02912 5B

Vertical-Horizontal Transport and Fate of Low Water Solubility Chemicals in Unsaturated Soils,
W87-03074 2G

Deterministic and Stochastic Analyses of Dispersion in an Unbounded Stratified Porous Medium,
W87-03196 5B

New Formula for the Analytical Solution of the Radial Dispersion Problem,
W87-03199 2F

Solute Yield From a Glacierized High Mountain Basin,
W87-03276 5B

Mechanisms of Dissolved Solids Transport in Flysch Drainage Basins,
W87-03281 5B

Stream Solute Behaviour in the River Exe Basin, Devon, UK,
W87-03286 5B

Atmospheric Inputs and River Transport of Dissolved Substances,
W87-03287 2B

SOLUTES
High Concentration of Solutes at the Upper Part of the Saturated Zone (Water Table) of a Deep Aquifer Under Sewage-Irrigated Land,
W87-02677 2F

Influence of Soil Structure on Movement Rate of Salts Through Soils,
W87-02716 5B

Transport of Solutes in Soil: Basic Features of Front Retardation,
W87-02733 5B

SOLUTES

Salt Tolerance in the Triticeae: Salinity-Induced Changes in the Leaf Solute Composition of Some Perennial Triticeae,
W87-02785 2I

Prediction of the Distribution Constant of some Solutes Containing Hydrophilic Functional Groups from Data on the Solubility of Water in Organic Solvents,
W87-02906 1B

SOLUTION MINING

Hydrometallurgy: Winning Metals with Water,
W87-02618 5G

SORGHUM

Management of Sorghum Under Limited Irrigation,
W87-02987 3F

Procedure to Select Drought-Tolerant Sorghum and Millet Genotypes Using Canopy Temperature and Vapor Pressure Deficit,
W87-03001 2I

Dryland Grain Sorghum Water Use, Light Interception, and Growth Response to Planting Geometry,
W87-03008 2I

Response of Conservation Tillage Sorghum to Growing Season Precipitation,
W87-03167 3F

SORPTION

Water Sorption Characteristics of Aluminum- and Calcium-Saturated Soil Clays,
W87-02728 2G

Sorption of Hydrophobic Trace Organic Compounds in Groundwater Systems,
W87-02730 5B

SOURIS RIVER

Burlington Spillway and Outlet Works Souris River, North Dakota: Hydraulic Model Investigation,
W87-03334 8B

SOUTH AFRICA

Assessment of the Impact of Eutrophication Control Measures on South African Impoundments,
W87-02973 5G

SOUTHEASTERN U.S.

Dealing with the Drought,
W87-02565 3F

SOYBEANS

Root Control of Leaf Phosphorus and Chlorine Accumulation in Soybean Under Salinity Stress,
W87-02984 2I

Salinity Tolerance of Winged Bean as Compared With That of Soybean,
W87-02988 3C

Growth and Yield of Sunflower and Soybean Under Soil Water Deficits,
W87-02992 2I

Gas Exchange of Field-Grown Soybean Under Drought,
W87-02999 2I

Water Use Efficiency in Soybean Pubescence Density Isolines-A Calculation Procedure for Estimating Daily Values,
W87-03000 2I

Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-03010 2I

SPARTINA

Survivorship and Spatial Development of Spartina alterniflora Loisel. (Gramineae) Seedlings in a New England Salt Marsh,
W87-03096 2L

SPARTINA ALTERNIFLORA

Biomass and Structure of a Spartina alterniflora Loisel.-dominated Salt Marsh in France,
W87-03203 2L

SPATIAL DISTRIBUTION

Observations of Spatial Variability of Soil-Water Pressure in a Field Soil,
W87-02713 2G

Determination of Rainfall Excess on Spatially Variable Catchments,
W87-02853 2A

Stochastic Approach to the Crop Yield-Irrigation Relationships in Heterogeneous Soils: I. Analysis of the Field Spatial Variability,
W87-02921 3F

SPAWNING HABITATS

Review and Analysis of Methods for Quantifying Instream Flow Requirements,
W87-02933 6D

SPECIES DIVERSITY

Distribution of Benthic Macroinvertebrates in a Stream Exposed to Urban Runoff,
W87-02939 5C

SPECTROPHOTOMETRY

Spectrophotometric Determination of Chromium in Waste Water and Soil,
W87-03052 5A

SPILLWAYS

Geological Problems Overcome at Revelstoke: Part Two,
W87-02692 8D

Burlington Spillway and Outlet Works Souris River, North Dakota: Hydraulic Model Investigation,
W87-03334 8B

SPILLWAYS *HYDROLOGIC MODELS

Evolution of PMP Cooperative Studies,
W87-03063 8A

SPLINE TECHNIQUE

Rational Allocation of Monitoring Stations in a Lake by Means of the Spline Technique,
W87-02598 7A

SPOIL DISPOSAL

Partial Review of Dredged Material Disposal Techniques,
W87-03259 5E

Selection and Management of a New Orlean Dredged Material Disposal Site at Coos Bay, Oregon, USA, to Receive Contaminated Dredged Material,
W87-03263 5E

Progressive Trenching Using a Scraper Digger,
W87-03268 5E

Mussel Watch Program/Monitoring the Long-Term Effects of Dredged Material Disposal in New England Waters,
W87-03270 5B

SPRING WATER

Study of Foamy Thermomineral Water of French Massif Central. I. Oxidation-reduction Potential and Behavior of Iron (Etude des eaux Thermominearales Carbogazeuses du Massif Central Francais. I. Potentiel d'Oxydo-Reduction et Comportement du Fer),
W87-03134 5B

Study of Foamy Thermomineral Water of French Massif Central. II. Behavior of Some Trace Metals, Arsenic, Antimony and Germanium, (Etude des Eaux Thermominerales Carbogazeuses du Massif Central Francais. II. Comportement de Quelques Metaux en Trace, de l'Arsenic, de l'Antimoine et du Germanium),
W87-03146 2K

SPRINGFIELD

Minimizing the Cost of Coping with Droughts: Springfield, Illinois,
W87-03057 6D

SPRINGS

Hydrological Investigations of Dinaric Karst at the Krcic Catchment and the River Krka Springs (Yugoslavia),
W87-02845 2A

SPRINKLER IRRIGATION

Responses of Sugarbeet to Deficit, High-Frequency Sprinkler Irrigation. I. Sucrose Accumulation, and Top and Root Dry Matter Production,
W87-02985 3F

Responses of Sugarbeet to Deficit, High-Frequency Sprinkler Irrigation. II. Sugarbeet Development and Partitioning to Root Growth,
W87-02986 3F

Yield and Physiological Responses of Potatoes to Deficit, High Frequency Sprinkler Irrigation,
W87-02997 3F

Comparison of Sprinkler and Flood Irrigation for Rice,
W87-03004 3F

Herbicides and Seeding Rate Effects on Sprinkler-Irrigated Rice,
W87-03013 2I

SPRINKLERS

Water Distribution Profiles for Sprinklers,
W87-02946 3F

Sprinkler Spacing Patterns,
W87-02947 3F

Drip and Minis, in the Commercial Landscape,
W87-02948 3F

SRI LANKA

Water-hammer Diagnostic Established by A Numerical Method, (Un Diagnostic de Coup de Belier Etabli par Modele Numerique),
W87-02577 8C

Environmental Chemistry of Rainwater in Sri Lanka,
W87-03023 2B

Chemistry of Tap Water in Sri Lanka - Implications on Health,
W87-03026 5F

Groundwater Occurrences in the Hard Rock Terrains of Sri Lanka - A Case Study,
W87-03047 2F

ST. CHARLES RIVER

Characterization of Water Using Combined Sewer Overflows, (Caracterization des Eaux Usees de Debordements de Reseau Unitaire),
W87-02672 5B

STABILITY ANALYSIS

Stability of Flows in Channels with Small Wall Curvature,
W87-02863 8B

Stability Criterion of a Laminar Flow,
W87-02868 8B

STANDING CROPS
Distribution and Standing Crop of Living and Dead Roots in Three Wetland Carex Species,
W87-03204 2H

STARCH
Starch Waste Treatment by the Activated Sludge System,
W87-02705 5D

STATE JURISDICTION
Colorado v. New Mexico II: Judicial Restraint in the Equitable Apportionment of Interstate Waters,
W87-02595 6E

Abstention: The Crooked Course of Colorado River,
W87-02596 6E

STATISTICAL ANALYSIS
Some Experimental Discussion of Accuracies in Quantitative Virus Assessment for Water Supply,
W87-02656 5A

Termination Criteria for Clay Permeability Testing,
W87-02788 2G

Extreme Value Theory Based on the r Largest Annual Events,
W87-03069 2L

Unbiased Plotting Positions for the General Extreme Value Distribution,
W87-03071 2E

Statistical Analysis of the Relationship Between Water Quality Parameters and Discharge at Eight Stations on the Rhine from 1959 to 1974 (Analyse Statistique des Relations Liant les Parametres de Qualite d'Eau et le Debit du Rhin en Huit Stations de 1959 a 1974),
W87-03282 5G

STATISTICAL FLOW FORECASTING
Selective Withdrawal: Basic Concepts,
W87-03222 8B

STATISTICAL METHODS
Use of Geostatistics to Predict Virus Decay Rates for Determination of Septic Tank Setback Distances,
W87-02895 5B

Goodness of Fit for Eight Water Infiltration Models,
W87-02923 2G

Application of Computer Intensive Statistics to Parameter Uncertainty in Streamflow Synthesis,
W87-02945 2E

Statistical Methods for Reservoir Water Quality Investigations,
W87-03322 7C

STATISTICAL MODELS
Goodness of Fit for Eight Water Infiltration Models,
W87-02923 2G

Application of Computer Intensive Statistics to Parameter Uncertainty in Streamflow Synthesis,
W87-02945 2E

STATISTICS
Statistical Technique for Analysis of Environmental Data Containing Periodic Variance Components,
W87-02599 7C

STEEL
Experiencein the Manufacture and Installation of the Reinforced Concrete-Encased Steel Pipelines of the Zagorsk Pumped-Storage Station,
W87-02869 8A

STEWART MOUNTAIN DAM
Alkali-Silica Reactivity in Five Dams in Southwestern United States,
W87-03319 8F

STOCHASTIC HYDROLOGY
Analysis of Stochastic Groundwater Problems. Part I: Deterministic Partial Differential Equations in Groundwater Flow. A Functional-Analytic Approach,
W87-02842 2F

Analysis of Stochastic Groundwater Flow Problems. Part II: Stochastic Partial Differential Equations in Groundwater Flow. A Functional-Analytic Approach,
W87-02843 2F

Analysis of Stochastic Groundwater Flow Problems. Part III: Approximate Solution of Stochastic Partial Differential Equations,
W87-02844 2F

STOCHASTIC PROCESS
Stochastic Dominance Comparison of Water-Conserving Irrigation Strategies,
W87-02873 3F

Stochastic Approach to the Crop Yield-Irrigation Relationships in Heterogeneous Soils: I. Analysis of the Field Spatial Variability,
W87-02921 3F

Stochastic Approach to the Crop Yield-Irrigation Relationships in Heterogeneous Soils: II. Application to Irrigation Management,
W87-02922 3F

Deterministic and Stochastic Analyses of Dispersion in an Unbounded Stratified Porous Medium,
W87-03196 5B

STOMATA RESISTANCE
Soil Compaction and Moisture Stress Preconditioning in Kentucky Bluegrass. II. Stomatal Resistance, Leaf Water Potential, and Canopy Temperature,
W87-02983 2G

STOMATAL CONDUCTANCE
Effects of In-Row and Interrow Subsoiling and Time of Nitrogen Application on Growth, Stomatal Conductance and Yield of Strip-Tilled Corn,
W87-03170 3F

STONEWALL JACKSON DAM
Selective Withdrawal From Any Level Between Minimum Pool and Spillway Elevation at Stonewall Jackson Dam, West Virginia,
W87-03245 8A

STORAGE RESERVOIRS
Overspeeding Processes in Reversible Units of Pumped-Storage Stations,
W87-03179 8C

Low-Head Pumped-Storage Station as a Way of Expanding the Tsimlyansk Hydroelectric Station,
W87-03182 8C

STORM EVENTS
Dual-use Filters Keep Wet-weather Flows Under Control,
W87-02926 5D

STORM RUNOFF
Establishing a Stormwater Management Utility,
W87-03123 2E

STORM WASTEWATER
Dual-use Filters Keep Wet-weather Flows Under Control,
W87-02926 5D

STORM WATER
Role of Detention Basins for Stormwater Quality Control,
W87-03301 5G

STRATIGRAPHY
Crater Lake, Oregon: A Restricted Basin with Base-of-Slope Aprons of Nonchannelized Turbidites,
W87-03220 2J

STRAWBERRIES
Nitrogen Source and Application Timing for Trickle Irrigated Strawberries,
W87-03109 3F

STREAM BANKS
Environmental Designs for Streambank Protection Projects,
W87-02621 6G

STREAM DEGRADATION
Erosion of Unconsolidated Gravel Beds,
W87-02673 2J

STREAM DISCHARGE
Review and Analysis of Methods for Quantifying Instream Flow Requirements,
W87-02933 6D

STREAM FAUNA
Leaf Litter Processing and the Associated Invertebrate Fauna in a Tallgrass Prairie Stream,
W87-03097 2H

STREAM IMPROVEMENTS
Stream Improvements and Fish Response: A Bio-engineering Assessment,
W87-02932 4A

Tenmile Creek: A study of Stream Relocation,
W87-02935 4A

STREAM POLLUTION
Distribution of Benthic Macroinvertebrates in a Stream Exposed to Urban Runoff,
W87-02939 5C

STREAM POWER
Forecasting Sediment Distribution in Reservoirs During Unstable Conditions,
W87-02680 2J

STREAM RELOCATION
Tenmile Creek: A study of Stream Relocation,
W87-02935 4A

STREAM STABILIZATION
Designing for Dynamic Equilibrium in Streams,
W87-02929 2E

STREAMBANK COVER
Effects of Variation in Streamside Habitats on the Composition of Mountain Salamander Communities,
W87-03082 2H

STREAMFLOW
Application of Computer Intensive Statistics to Parameter Uncertainty in Streamflow Synthesis,
W87-02945 2E

STREAMS
Macrophyte Growth in Shallow Streams: Field Investigations,
W87-02887 5C

Macrophyte Growth in Shallow Streams: Biomass Model,
W87-02888 5C

Designing for Dynamic Equilibrium in Streams,
W87-02929 2E

In Situ Stream Water Clarifying Tests,
W87-03265 5G

Dissolved Loads in Streams and Rivers - Discharged and Seasonally Related Variations,
W87-03279 5B

Regional Analysis of Water Quality in Major Streams of the United States,
W87-03284 5G

Stream Solute Sources and Variations in a Temperate Granite Drainage Basin,
W87-03296 5B

STREPTOCOCCUS
Effect of Organotins on Fecal Pollution Indicator Organisms,
W87-02901 5C

STRESS
Primary and Secondary Stress Responses of Striped Bass (Morone saxatilis) Exposed to Benzene,
W87-02771 5C

STRESS ANALYSIS
Characteristics of the Static Performance of Dams Reservoired Hydroelectric Stations,
W87-02866 8A

STRIP-TILLAGE
Effects of In-Row and Interrow Subsoiling and Time of Nitrogen Application on Growth, Stomatal Conductance and Yield of Strip-Tilled Corn,
W87-03170 3F

STRUCTURAL BEHAVIOR
Development of a Collision Tolerant Pile Structure Concept,
W87-03219 8A

STRUCTURAL ENGINEERING
Effective Technology of Constructing Earth Structures,
W87-02864 8A

Development of a Collision Tolerant Pile Structure Concept,
W87-03219 8A

Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures.
W87-03221 8A

STRUCTURES
Design of Selective Withdrawal Intake Structures,
W87-03237 8A

Field Measurements at Intake Structures,
W87-03240 8B

SUBLETHAL EFFECTS
Absence of Acclimation to Parathion by Rainbow Trout During Sublethal Exposure,
W87-02697 5C

Primary and Secondary Stress Responses of Striped Bass (Morone saxatilis) Exposed to Benzene,
W87-02771 5C

SUBMERSIBLE PUMPS
Sizing Submersible Pumps,
W87-02927 8C

SUBSIDIES
Distribution of Economic Rents Arising from Subsidized Water When Land is Leased,
W87-02874 6C

SUBSOILING
Effect of Subsoiling and Irrigation on Potato Production,
W87-03169 3F

Effects of In-Row and Interrow Subsoiling and Time of Nitrogen Application on Growth, Stomatal Conductance and Yield of Strip-Tilled Corn,
W87-03170 3F

SUBSURFACE ENVIRONMENT
Microbiology of Subsurface Environments.
W87-03325 2F

SUBSURFACE WATER
Biodegradation of Methanol and Tertiary Butyl Alcohol in Subsurface Systems,
W87-02732 5B

SUCROSE
Responses of Sugarbeet to Deficit, High-Frequency Sprinkler Irrigation. I. Sucrose Accumulation, and Top and Root Dry Matter Production,
W87-02985 3F

SUFFOLK COUNTY
Petroleum Recovery Operations in an Urban Area,
W87-03065 5G

SULFATES
Anomalous Natural Sulfate in Water Wells of the Greenbrier Group, West Virginia,
W87-02625 5B

Effect of High Sulfate Irrigation Waters on Soil Salinity and Yields,
W87-02996 3C

SULFIDES
Effects of Sulphide on Survival of Aero-Aquatic and Aquatic Hyphomycetes,
W87-03174 5C

SULFITE LIQUORS
Mixed-Culture Microbial Protein from Waste Sulfite Pulping Liquor II: Its Production on a Pilot-Plant Scale and Use in Animal Feed,
W87-03132 5E

SULFUR CYCLE
Orthanilic Acid and Analogues as Carbon Sources for Bacteria: Growth Physiology and Enzymic Desulphonation,
W87-02781 5D

Impacts from Mosquito Control-Induced Sulphur Mobilization in a Cape Cod Estuary,
W87-03127 5C

SUNFLOWER
Growth and Yield of Sunflower and Soybean Under Soil Water Deficits,
W87-02992 2I

SUPERSATURATION
Response of Cloud Supersaturation to Radiative Forcing,
W87-03214 2B

SURFACE IRRIGATION
Spatial Variability and Soil Sampling for Salinity and Sodicity Appraisal in Surface Irrigated Orchards,
W87-02726 2G

SURFACE WATER
Antidegradation Policy for Preserving Surface Water Quality in Florida,
W87-02636 5G

Sanitary Study of Surface Water and of the Beach of a Water Sports and Leisure Complex,
W87-02777 5B

Hydrological Investigations of Dinaric Karst at the Krcic Catchment and the River Krka Springs (Yugoslavia),
W87-02845 2A

Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships.
W87-03272 5B

SURFACE WATERS
Dissolved Material Concentration in Surface Waters of Africa. Two Contrasting Examples in the Rivers of Togo and the Medjerdah in Tunisia (Evolution de la Concentration en Matieres Dissoutes en Afrique. Deux Exemples Opposes: les Fleuves du Togo et la Medjerdah en Tunisie),
W87-03277 5B

SURFACTANTS
Distribution of Anionic Surfactants in the Water Column of the Gulf of Fos-sur-Mer, (Distribution des Detergents Anioniques dans la Colonne d'Eau du Golfe de Fos-sur-Mer),
W87-02563 5B

SURGE TANKS
Computation of Hydraulic Transients in Complex Hydro Schemes,
W87-03036 8A

SURVEYS
Analysis of Tap Water for Viruses: Results of a Survey,
W87-02652 5A

Detection of Indigenous Enteric Viruses in Raw Sewage Effluents of the City of Athens, Greece, during a Two Year Survey,
W87-02659 5B

SURVIVAL
Rotavirus Survival in Raw and Treated Waters and Its Health Implications,
W87-02644 5G

Bacteria and Viruses in Aerobically Digested Sludge: Influence of Physical and Chemical Treatments on Survival and Association with Flocs under Laboratory Conditions,
W87-02660 5D

Plains Cottonwood Recruitment and Survival on a Prairie Meandering River Floodplain, Milk River, Southern Alberta and Northern Montana,
W87-02769 2I

Effects of Sulphide on Survival of Aero-Aquatic and Aquatic Hyphomycetes,
W87-03174 5C

SUSPENDED LOAD
Historic Trends in the Sediment Flow Regime of the Mississippi River,
W87-03195 2J

Dissolved and Suspended Loads of the Regulated River Nidda in the Rhine-Main Area,
W87-03299 5B

SUSPENDED SEDIMENTS
Measuring Suspended Sediment in Small Mountain Streams,
W87-03324 5A

Controlling Suspended Sediment Samplers by Programmable Calculator and Interface Circuitry,
W87-03337 7B

SUSPENDED SOLIDS
Measuring Sludge Concentration and Quality,
W87-02835 5D

Nutrient and Trace Metal Fluxes in the Magela Creek System, Northern Australia,
W87-02974 2E

SUTTON LAKE
Selective Experiences: Alias Withdrawal Pains,
W87-03246 6B

SWAMP SEDIMENTS
Acyclic Archaebacterial Ether Lipids in Swamp Sediments,
W87-03141 5A

SWEDEN
Deposition of Atmospheric Trace Metals in Northern Sweden as Measured in the Snowpack,
W87-02720 5B

Temporal Evolution of Nitrogen Compounds in Swedish Precipitation Since 1955,
W87-02812 2B

SWITZERLAND
Study of Acid Deposition in Switzerland: Temporal Variation in the Ionic Composition of Wet Precipitation at Rural Sites During 1983-1984,
W87-02763 5B

Tritium Corrected 14C and Atmospheric Noble Gas Corrected 4He Applied to Deduce Ages of Mixed Groundwaters: Examples from the Baden Region, Switzerland,
W87-03147 5A

TADAMI PROJECT
65 MW Bulb Turbine for Japan's Tadami Project,
W87-02691 8C

TAKMU FISH FARM
Association Between Some Planktonic Species and Physicochemical Characteristics of the Water of Loktak Lake, Manipur, India,
W87-03025 2H

TALL FESCUE
Relationships Between Growth and Measured Weather Factors Among Contrasting Varieties of Lolium, Dactylis and Festuca Species,
W87-03100 2I

TALLGRASS PRAIRIE
Leaf Litter Processing and the Associated Invertebrate Fauna in a Tallgrass Prairie Stream,
W87-03097 2H

TAMA RIVER
Modeling for Estimating Representative Water Conditions in a River Basin,
W87-02604 5B

TANK CLEANING
Professional Tank Cleaning Can Make a Difference,
W87-03080 5D

TAP WATER
Chemistry of Tap Water in Sri Lanka - Implications on Health,
W87-03026 5F

TAXONOMY
Effects of Current Velocity and Light Energy on the Structure of Periphyton Assemblages in Laboratory Streams,
W87-02808 2H

TDWHCX MODEL
Vertical-Horizontal Transport and Fate of Low Water Solubility Chemicals in Unsaturated Soils,
W87-03074 2G

TECHNOLOGY
Application of Aluminas in Water Treatment,
W87-02752 5D

Low Level Radioactive Waste Disposal--Technology and Public Policy,
W87-02775 5E

More Awareness Sought Concerning Role of Metals in Pollution,
W87-02791 5B

Effective Technology of Constructing Earth Structures,
W87-02864 8A

TELEVISION
Borehole Television for Geotechnical Investigations,
W87-03032 7B

TEMPERATURE
Effects of Temperature, Salinity, Irradiance and Diurnal Periodicity on Growth and Photosynthesis in the Diatom Nitzschia americana: Light-Saturated Growth,
W87-02807 2L

Regime of Ground Water of Semberian Aquifer,
W87-03043 2F

Accumulation and Turnover of Abecisic Acid in Osmotically Stressed Cotton Leaf Tissue in Relation to Temperature,
W87-03216 2I

TEMPERATURE EFFECTS
Dealing with the Drought,
W87-02565 3F

Combined Effect of Hysteresis and Temperature on Soil-Water Movement,
W87-02857 2G

Temperature Dependence of Soil Water Retention Curves,
W87-02914 2G

Procedure to Select Drought-Tolerant Sorghum and Millet Genotypes Using Canopy Temperature and Vapor Pressure Deficit,
W87-03001 2I

Relationships Between Growth and Measured Weather Factors Among Contrasting Varieties of Lolium, Dactylis and Festuca Species,
W87-03100 2I

Irrigation Scheduling Effects on Container Media and Canopy Temperatures and Growth of 'Hershey's Red' Azalea,
W87-03103 3F

TEMPORAL VARIATION
Study of Acid Deposition in Switzerland: Temporal Variation in the Ionic Composition of Wet Precipitation at Rural Sites During 1983-1984,
W87-02763 5B

TENMILE CANYON
Tenmile Creek: A study of Stream Relocation,
W87-02935 4A

TENMILE CREEK
Tenmile Creek: A study of Stream Relocation,
W87-02935 4A

TENNESSEE-TOMBIGBEE *WATERWAY
Riprap Stability and Navigation Tests for the Divide-Cut Section Tennessee-Tombigbee Waterway,
W87-03317 8A

TENSION INFILTROMETER
Estimating Macroporosity in a Forest Watershed by use of a Tension Infiltrometer,
W87-02917 2G

TEXAS
Spatial Variability and Soil Sampling for Salinity and Sodicity Appraisal in Surface Irrigated Orchards,
W87-02726 2G

Voter Reactions to the 1976 Water Development and Quality Referenda in Texas,
W87-02944 6E

THALASSIOSIRA
Relationships Among Growth Rate, Cellular Manganese Concentrations and Manganese Transport Kinetics in Estuarine and Oceanic Species of the Diatom Thalassiosira,
W87-02805 2L

THALLIUM
Determination of Lead, Cadmium and Thallium in Water Samples at ppb and ppt Levels by Isotope Dilution Mass Spectrometry, (Bestimmung von Blei, Cadmium und Thallium in Wasserproben im ppb- und ppt-Bereich durch massenspektrometrische Isotopenverdunnungsanalyse),
W87-02795 5A

THERMAL SPRINGS
Metabolical Activity of Bacteria in Geothermal Spring-waters Dating from Dogger and Trias Periods in the Bassin Parisien, (Activites Metaboliques des Bacteries des Eaux Geothermales du Dogger et du Trias du Bassin Parisien),
W87-02562 5B

THERMAL STRATIFICATION
Modelling of Stratified Flow and Eutrophication in Reservoirs,
W87-02968 5C

Three-dimensional Water-Quality-Transport Model Compared with Field Observations,
W87-02970 2H

Mathematical Prediction of Thermal Stratification of Lake Ostrovo (Vegoritis), Greece,
W87-03198 2H

THERMAL WATER
Saline- versus Freshwater Contribution to the Thermal Waters of the Northern Jordan Rift Valley, Israel,
W87-02852 2F

THERMO MINERAL WATER
Study of Foamy Thermomineral Water of French Massif Central. I. Oxidation-reduction Potential and Behavior of Iron (Etude des eaux Thermominearales Carbogazeuses du Massif Central Francais. I. Potentiel d'Oxydo-Reduction et Comportement du Fer),
W87-03134 5B

THERMODYNAMICS
Thermodynamic Study of Solutions of Liquid Hydrocarbon Mixtures in Water,
W87-03145 1B

THERMOMINERAL WATER
Study of Foamy Thermomineral Water of French Massif Central. II. Behavior of Some Trace Metals, Arsenic, Antimony and Germanium, (Etude des Eaux Thermominerales Carbogazeuses du Massif Central Francais. II. Comportement de Quelques Metaux en Trace, de l'Arsenic, de l'Antimoine et du Germanium),
W87-03146 2K

THERMOPHILIC BACTERIA
Metabolical Activity of Bacteria in Geothermal Spring-waters Dating from Dogger and Trias Periods in the Bassin Parisien, (Activites Metaboliques des Bacteries des Eaux Geothermales du Dogger et du Trias du Bassin Parisien),
W87-02562 5B

TIDAL EFFECTS
Modeling of Pollutant Dispersion in Stratified Oscillatory Flows,
W87-02885 5B

Slack Tide Oxygen Balance Model,
W87-02889 5B

TIDAL POWERPLANTS
Time and Tide Are Right for the Severn Barrage,
W87-03091 8A

TIDAL RIVERS
Nutrient and Sediment Budgets for the Tidal Potomac River and Estuary,
W87-03290 5B

TILLAGE
Response of Corn to Tillage and Delayed Irrigation,
W87-03007 2I

Effects of Tillage Methods and Water Regimes on Soil Properties and Yield of Lowland Rice from a Sandy Loam Soil in Southwest Nigeria,
W87-03164 2I

Effect of Tillage and Mulching on Soil Environment and Cowpea Seedling Growth Under Arid Conditions,
W87-03166 3F

TILLAGE DEPTH
Compaction and Tillage Depth Combinations for Water Management and Rice Production in Low-Retentive Permeable Soils,
W87-03163 3F

TILLAGE PANS
Corn Irrigation Scheduling in Humid Regions on Sandy Soils with Tillage Pans,
W87-02981 3F

TILLERS
Water Deficit During Panicle Development in Pearl Millet: Yield Compensation by Tillers,
W87-03157 2I

TIME SERIES ANALYSIS
Evaluation of Weekly and Monthly Time Series Forecasts of Municipal Water Use,
W87-02629 6A

TIN
Determination of Traces of Tin in Aqueous Matrices by Voltammetry and Atomic Absorption Spectrometry, (Bestimmung von Zinnspuren in wassrigen Matrices mit Voltammetrie und Atomabsorptionsspektrometrie),
W87-02796 5A

Geochemistry of Tin in Rivers and Estuaries,
W87-03140 5B

TISSUE ANALYSIS
Relationships Among Growth Rate, Cellular Manganese Concentrations and Manganese Transport Kinetics in Estuarine and Oceanic Species of the Diatom Thalassiosira,
W87-02805 2L

Influence of Climatic Factors and Forage Age on the Chemical Components of Ryegrass Related to Grass Tetany,
W87-02980 2I

Decline of the Gastropod Nucella lapillus Around South-West England: Evidence for the Effect of Tributyltin from Antifouling Paints,
W87-03053 5C

Liquid Chromatographic Determination of Fluridone Aquatic Herbicide and Its Metabolite in Fish and Crayfish,
W87-03113 5A

Interlaboratory Comparison of Analyses for Heavy Metals in Clam Tissue,
W87-03114 5A

TOKYO BAY
Basin-wide Ecological Fate Model for Management of Chemicals Hazard,
W87-02975 5B

TOMATO
Potassium Utilization and Fluxes in Wild Salt-Tolerant Relatives of the Cultivated Tomato,
W87-03055 2I

TOMATOES
Growth and Nutritional Status of Petunia and Tomato Seedlings with Acidified Irrigation Water,
W87-03105 5C

TOPSOIL
Nitrilotriacetic Acid in Sludge-amended Soil: Mobility and Effects on Metal Solubility,
W87-02765 5E

TOXICITY
Absence of Acclimation to Parathion by Rainbow Trout During Sublethal Exposure,
W87-02697 5C

Effects of Chloroform Toxicity on Methane Fermentation,
W87-02704 5D

Primary and Secondary Stress Responses of Striped Bass (Morone saxatilis) Exposed to Benzene,
W87-02771 5C

Toxicity of Brass Dust to the Microalgae Ankistrodesmus falcatus and Selenastrum capricornutum,
W87-02778 5C

Effect of Metal Chelation on the Toxicity of Some Environmentally Hazardous Trace Metals to Daphnia magna,
W87-03024 5G

Acute and Chronic Toxicity of Nickel to Larvae of Chironomus riparis (Meigen),
W87-03083 5C

Boron Tolerance and Accumulation in the Duckweed, Lemna minor,
W87-03152 5C

Micronutrient Tolerance and Accumulation in the Duckweed, Lemna,
W87-03153 5C

Test of a Proposed Organizational Framework for the Ordering of Algal Toxicity Responses,
W87-03205 5C

TOXINS
Management of Bottom Sediments Containing Toxic Substances.
W87-03248 5G

TRACE ELEMENTS
Multielement Trace Preconcentration from Water on Activated Carbon for the Sample Pretreatment for Atomic Spectroscopy (Flame-AAS, ICP/OES), (Multielement-Spurenanreicherung aus Wassern an Aktivkohle zur Probenvorbereitung fur die Atomspektroskopie (Flammen-AAS, ICP/OES)),
W87-02799 5A

Investigations on the Application of the Ion-Exchanger SRAFION NMRR for the Enrichment and Separation of Uranium and Other Trace Elements from Sea Water, (Untersuchungen uber die Verwendbarkeit des Ionenaustauschers SRAFION NMRR zur Anreicherung und Abtrennung von Uran und anderen Spurenelementen aus dem Meerwasser),
W87-02803 5A

Relationships Among Growth Rate, Cellular Manganese Concentrations and Manganese Transport Kinetics in Estuarine and Oceanic Species of the Diatom Thalassiosira,
W87-02805 2L

TRACE LEVELS
Possibilities of Improving the Determination of Extremely Low Lead Concentrations in Marine Fish by Graphite Furnace Atomic Absorption Spectrometry,
W87-02794 5A

Determination of Lead, Cadmium and Thallium in Water Samples at ppb and ppt Levels by Isotope Dilution Mass Spectrometry, (Bestimmung von Blei, Cadmium und Thallium in Wasserproben im ppb- und ppt-Bereich durch massenspektrometrische Isotopenverdunnungsanalyse),
W87-02795 5A

Determination of Traces of Tin in Aqueous Matrices by Voltammetry and Atomic Absorption Spectrometry, (Bestimmung von Zinnspuren in wassrigen Matrices mit Voltammetrie und Atomabsorptionsspektrometrie),
W87-02796 5A

Trace Determination of Chromium in Various Water Types by Adsorption Differential Pulse Voltammetry,
W87-02797 5A

Preservation of Traces of Chromium(VI) in Water and Waste Water Samples,
W87-02804 5A

TRACE METALS
Deposition of Atmospheric Trace Metals in Northern Sweden as Measured in the Snowpack,
W87-02720 5B

Organic and Trace Metal Levels in Ocean Quahog, Arctica islandica Linne, from the Northwestern Atlantic,
W87-02759 5B

Nutrient and Trace Metal Fluxes in the Magela Creek System, Northern Australia,
W87-02974 2E

Effect of Metal Chelation on the Toxicity of Some Environmentally Hazardous Trace Metals to Daphnia magna,
W87-03024 5G

Insecticides and Metals in Nigerian Surface Water - Warri River,
W87-03028 5B

Study of Foamy Thermomineral Water of French Massif Central. II. Behavior of Some Trace Metals, Arsenic, Antimony and Germanium, (Etude des Eaux Thermominerales Carbogazeuses du Massif Central Francais. II. Comportement de Quelques Metaux en Trace, de l'Arsenic, de l'Antimoine et du Germanium),
W87-03146 2K

Determination of Organically-associated Trace Metals in Estuarine Sea-Water by Solvent Extraction and Atomic-Absorption Spectrometry,
W87-03173 5A

TRACERS
Generalization and Applications of Tracer Dispersion Data,
W87-02620 5B

Interpretation of Tracer Data in Variable Flow Systems,
W87-03070 7B

Transport of Conservative Tracers in the Field Under Intermittent Flood Irrigation,
W87-03191 2G

New Formula for the Analytical Solution of the Radial Dispersion Problem,
W87-03199 2F

TRANSLOCATION
Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: I. Salinity During Growth Modulates the Proton Pump in the Halophyte Atriplex Nummularia,
W87-02717 2I

Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: II. K(+) Strongly Promotes Development of Membrane Potential in Vesicles from Cotton Roots,
W87-02718 2I

TRANSMISSION CONSTANT
Non-Darcian Transmission of Water in Certain Humified Peats,
W87-02846 2G

TRANSMISSIVITY
Aquifer Transmissivity of Porous Media from Resistivity Data,
W87-02837 7B

Comparative Analysis of Transmissivity and Hydraulic Conductivity Values from the Ajali Aquifer System of Nigeria,
W87-02859 2F

TRANSPIRATION
Interactive Effects of Nitrogen and Water Stresses on Water Relations of Field-Grown Corn Leaves,
W87-02994 2I

Gas Exchange of Field-Grown Soybean Under Drought,
W87-02999 2I

Effects of Carbon Dioxide Enrichment and Soil Water on Maize,
W87-03002 2I

TRANSPLANTING
Muskmelon Growth, Yield, and Nutrition as Influenced by Planting Method and Trickle Irrigation,
W87-03108 3F

TRANSPORT
Three-dimensional Water-Quality-Transport Model Compared with Field Observations,
W87-02970 2H

Nutrient and Trace Metal Fluxes in the Magela Creek System, Northern Australia,
W87-02974 2E

TREES
Interactive Effects of Sewage Effluent Irrigation and Supplemental Fertilization on Container-Grown Trees,
W87-02958 3C

TRENCHES
Progressive Trenching Using a Scraper Digger,
W87-03268 5E

TRIADIMEFON
Triadimefon Protects Bean Plants from Water Stress through its Effects on Abscisic Acid,
W87-03202 2I

TRIBUTYL TIN
Decline of the Gastropod Nucella lapillus Around South-West England: Evidence for the Effect of Tributyltin from Antifouling Paints,
W87-03053 5C

TRICKLE IRRIGATION
Infiltration and Water Extraction from Trickle Irrigation Source: The Effective Hemisphere Model,
W87-02725 2G

Tips on Trickle,
W87-02761 3F

Trickle Irrigation of Wheat Applying Renovated Wastewater,
W87-02938 3F

Trickle Irrigation System for Recycling Residential Wastewater on Fruit Trees,
W87-02955 3C

Interactive Effects of Trickle Irrigation Rates, Cultivars, and Culture on Cut Chrysanthemum,
W87-02959 3F

Muskmelon Growth, Yield, and Nutrition as Influenced by Planting Method and Trickle Irrigation,
W87-03108 3F

Nitrogen Source and Application Timing for Trickle Irrigated Strawberries,
W87-03109 3F

TRIHALOMETHANES
Trihalomethane Levels in Chlorinated Michigan Drinking Water,
W87-02605 5F

Bacteria Associated with Granular Activated Carbon Particles in Drinking Water,
W87-02891 5B

TRITIUM
Tritium Corrected 14C and Atmospheric Noble Gas Corrected 4He Applied to Deduce Ages of Mixed Groundwaters: Examples from the Baden Region, Switzerland,
W87-03147 5A

TROPHIC LEVELS
Modelling of the Lower Trophic Levels of a Marine Ecosystem and Its Example of Short-period Variations of Chlorophyll and Nutrient in Harima-Nada,
W87-02601 2L

TROPIC ZONE
Review of Field Observations of Runoff Generation in the Tropics,
W87-02675 2E

TROPICAL ALFISOL
Mechanized Tillage Systems Effects on Properties of a Tropical Alfisol in Watersheds Cropped to Maize,
W87-03162 2G

TROPICAL REGIONS
Chemical Mass Balance of a Small Basin in a Wet Monsoonal Environment and the Effect of Fast-Growing Plantation Forest,
W87-03291 2H

TSIMLYANSK
Low-Head Pumped-Storage Station as a Way of Expanding the Tsimlyansk Hydroelectric Station,
W87-03182 8C

TUCSON
Research Design for Tucson Aqueduct, Phase B Data Recovery,
W87-03328 6G

Supplemental Class III Archaeological Survey of the Phase A, Reach 3 Corridor, Tucson Aqueduct, Central Arizona Project: Late Sedentary and Early Classic Period Tucson Basin Hohokam Occupation in the Lower Santa Cruz Basin, Marana to Rillito, Arizona,
W87-03329 6G

TUNDRA
Atmospheric Methane Sources: Alaskan Tundra Bogs, an Alpine Fen, and a Subarctic Boreal Marsh,
W87-02719 5B

TUNNEL CONSTRUCTION
Use of Grouting When Driving Through the Rock Burst Zone in the Dangara Irrigation Tunnel,
W87-03181 8E

TUNNELS
Borehole Television for Geotechnical Investigations,
W87-03032 7B

Tunnels: Machine Excavation - Rate of Progress - Machine Data,
W87-03320 8A

TURBIDITES
Crater Lake, Oregon: A Restricted Basin with Base-of-Slope Aprons of Nonchannelized Turbidites,
W87-03220 2J

TURBINE AUTOMATIC CONTROL SYSTEM
Automation of a Chain of Run-of-River Power Stations,
W87-03035 8C

TURBINES
Creation of a Cross-Flow Turbines Range, (Creation d'une Gamme de Turbines a Flux Traversant),
W87-02569 8C

Economy and Performance of Small Turbines, (Economie et Performance des Petites Turbines),
W87-02570 8C

Small Hydroelectric Power Plants for Very Low Heads, (Les Usines de Tres Basse Chute en Mini-Hydroelectricite),
W87-02571 8C

Overpressure Peak in Dual Horizontal Francis Turbines: Industrial Experiments Results, (Pic de Surpression des Francis Horizontales Doubles: Resultats d'Experiences Industrielles),
W87-02578 8C

Influence of the Runner Blade Angle Variation on Kaplan Turbine Transients, (Influence de la Variation d'Inclinaison des Pales sur les Regimes Transitoires des Turbines Kaplan),
W87-02579 8C

Materials Technology for Turbine Performance,
W87-02687 8C

Waterhammer Pressure Compensation in Turbine Regulating Systems,
W87-02690 8C

65 MW Bulb Turbine for Japan's Tadami Project,
W87-02691 8C

Self-closing Cylindrical Gate Improves Safety at Low Cost,
W87-02693 8C

Experience of Using the Turbine-Generator Units of the Kolyma Hydroelectric Station for Idle Discharge of Water,
W87-03177 8C

TURBULENT FLOW
Analysis of the Velocity Field in a Boundary Layer Generated by a Water Wave, (Analyse du Champ des Vitesses dans la Couche Limite Generee par une Onde Progressive (Houle)),
W87-02790 8B

TURF GRASSES
Sprinkler Spacing Patterns,
W87-02947 3F

Differential Sensitivity of Turfgrass Organs to Water Stress,
W87-02962 2I

Soil Compaction and Moisture Stress Preconditioning in Kentucky Bluegrass. I. Soil Aeration, Water Use, and Root Responses,
W87-02982 2G

Turfgrass Water Use Rates,
W87-03014 2I

Managing Water for Turfgrass,
W87-03016 2I

Controlling Turfgrass Water Use Rates,
W87-03017 2I

TURF GRASSES

Drought Avoidance in Tall Fescue,
W87-03019 2I

Soils Influence Irrigation,
W87-03020 2G

TWIN LAKES
Primary Productivity (C14) at Twin Lakes Colorado: 1973-81 Study Results,
W87-03326 2H

TYNE RIVER
Wave Movement and Water-Quality Variations During a Controlled Release from Kielder Reservoir, North Tyne River, U. K.,
W87-02681 2E

ULTRAFILTRATION
Concentration of Seeded and Naturally Occurring Enteroviruses from Waters of Varying Quality by Hollow Fiber Ultrafiltration,
W87-02648 5A

Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial Wastewater Reuse and Priority Pollutant Removal,
W87-02753 5D

ULTRAVIOLET RADIATION
Use of Ultraviolet Light in the Treatment of Water in Public Spas and Hot Tubs,
W87-02755 5F

ULVA
Effects of Light on Growth, RuBPCase Activity and Chemical Composition of Ulva Species (Chlorophyta),
W87-02809 2L

UNDERGROUND STORAGE
Under EPA Scrutiny: Underground Storage Tanks,
W87-03021 5B

UNDERGROUND SYSTEMS
Instruments and Expertise Add Up to Good Pipe Locating,
W87-02928 8C

UNDERSTORY
Evaporation from the Understorey in the Jarrah (Eucalyptus Marginata Don Ex Sm.) Forest, Southwestern Australia,
W87-02679 2D

UNITED STATES
Drought Policy in the U.S. and Australia: A Comparative Analysis,
W87-02937 6E

UNSATURATED FLOW
Unsaturated Flow Through Solid Waste Landfills: Model and Sensitivity Analysis,
W87-02628 5B

UPFLOW SLUDGE BLANKET REACTOR
Effect of Effluent Recirculation on the Performance of a Two Stage Anaerobic Process,
W87-03088 5D

UPLANDS
Modelling the Effects of Acidic Deposition And Conifer Afforestation on Stream Acidity in the British Uplands,
W87-03068 5C

Microclimate of an Upland Grassland,
W87-03101 2I

URANIUM
Investigations on the Application of the Ion-Exchanger SRAFION NMRR for the Enrichment and Separation of Uranium and Other Trace Elements from Sea Water, (Untersuchungen uber die Verwendbarkeit des Ionenaustauschers SRAFION NMRR zur Anreicherung und Abtrennung von Uran und anderen Spurenelementen aus dem Meerwasser),
W87-02803 5A

URBAN AREAS
Study of Acid Deposition in Switzerland: Temporal Variation in the Ionic Composition of Wet Precipitation at Rural Sites During 1983-1984,
W87-02763 5B

Petroleum Recovery Operations in an Urban Area,
W87-03065 5G

URBAN DRAINAGE
Overcoming Natural and Man-Made Obstacles to Solve Urban Flooding Problems,
W87-03118 4C

URBAN RUNOFF
Distribution of Benthic Macroinvertebrates in a Stream Exposed to Urban Runoff,
W87-02939 5C

VARANASI
Water Supply of Varanasi - The Oldest City of India,
W87-03039 5F

VARIED FLOW
Interpretation of Tracer Data in Variable Flow Systems,
W87-03070 7B

VEGETABLE CROPS
Problems of Using Wastewater on Vegetable Crops,
W87-02954 3C

VELOCITY
Analysis of the Velocity Field in a Boundary Layer Generated by a Water Wave, (Analyse du Champ des Vitesses dans la Couche Limite Generee par une Onde Progressive (Houle)),
W87-02790 8B

VELOCITY GRADIENT
Innovative Technique for Determining Velocity Gradient in Coagulation--Flocculation Process,
W87-02708 5F

VENICE
Extreme Value Theory Based on the r Largest Annual Events,
W87-03069 2L

VERTICAL DIFFUSION
Vertical Diffusion in Meromictic Powell Lake, British Columbia,
W87-02780 2H

VERTICAL FLOW
Vertical-Horizontal Transport and Fate of Low Water Solubility Chemicals in Unsaturated Soils,
W87-03074 2G

VESICLES
Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: II. K(+) Strongly Promotes Development of Membrane Potential in Vesicles from Cotton Roots,
W87-02718 2I

VIRAL GASTROENTERITIS
Waterborne Viral Gastroenteritis,
W87-02612 5C

VIRAL INACTIVATION
Behaviour of Coliphages in Oxidation Ponds,
W87-02666 5D

VIRGINIA
Virginia, North Carolina Wage Water-Rights Battle,
W87-02638 6E

Characterization and Classification of Seaside-Salt-marsh Soils on Virginia's Eastern Shore,
W87-02919 2L

VIRUS REMOVAL
Enterovirus Removal from Sewage: The Effectiveness of Four Different Treatment Plants,
W87-02706 5D

VIRUS TRANSMISSION
Rotavirus Survival in Raw and Treated Waters and Its Health Implications,
W87-02644 5G

VIRUSES
Genomic Analysis of RNA Viruses Isolated from Water,
W87-02645 5A

Detection of Hepatitis A Virus (HAV) in Drinking Water,
W87-02646 5A

Detection of Hepatitis A Virus in Drinking Water by Enzyme-Immunoassay Using Ultracentrifugation for Virus Concentration,
W87-02647 5A

Recovery of Viruses from Drinking-Water by Means of an In-Line Electropositive Cartridge Filter,
W87-02649 5A

Concentration of Viruses from Water Using Pig Erythrocyte Ghost Cells,
W87-02650 5A

Analysis of Tap Water for Viruses: Results of a Survey,
W87-02652 5A

Detection and Health Risk Associated with Low Virus Concentration in Drinking Water,
W87-02653 5A

Viruses and Bacteria in a Chalk Well,
W87-02655 5B

Some Experimental Discussion of Accuracies in Quantitative Virus Assessment for Water Supply,
W87-02656 5A

Interactions between Biotic and Abiotic Factors and Viruses in a Water System,
W87-02657 5B

Virus Removal by Activated Sludge Treatment,
W87-02658 5D

Bacteria and Viruses in Aerobically Digested Sludge: Influence of Physical and Chemical Treatments on Survival and Association with Flocs under Laboratory Conditions,
W87-02660 5D

Virus Inactivating Effect of Anaerobic Mesophilic Digestion of Municipal Sludge With or Without Different Preceding Types of Treatment,
W87-02661 5D

Electrofocusing of Viruses and Sensitivity to Disinfection,
W87-02664 5D

Study of Indigenous Virus Removal at Different Stages in a Drinking Water Plant Treating River Water,
W87-02665 5F

Human Viruses in Sediments, Sludges, and Soils,
W87-02768 5B

Use of Geostatistics to Predict Virus Decay Rates for Determination of Septic Tank Setback Distances,
W87-02895 5B

Development of a Method for Concentration of Rotavirus and Its Application to Recovery of Rotaviruses from Estuarine Waters,
W87-02896 5A

Method for Determining Virus Inactivation During Sludge Treatment Processes,
W87-02898 5A

Humic Acid Interference with Virus Recovery by Electropositive Microporous Filters,
W87-02900 5A

VOLTAMMETRY
Determination of Traces of Tin in Aqueous Matrices by Voltammetry and Atomic Absorption Spectrometry, (Bestimmung von Zinnspuren in wassrigen Matrices mit Voltammetrie und Atomabsorptionsspektrometrie),
W87-02796 5A

Trace Determination of Chromium in Various Water Types by Adsorption Differential Pulse Voltammetry,
W87-02797 5A

VOTER REACTIONS
Voter Reactions to the 1976 Water Development and Quality Referenda in Texas,
W87-02944 6E

WAIALAE AQUIFER
Comparison of the Coupled Fresh Water-Salt Water Flow and the Ghyben-Herzberg Sharp Interface Approaches to Modeling of Transient Behavior in Coastal Aquifer Systems,
W87-03077 2F

WAKES
Evolution of a Single Wake Behind a Pair of Bluff Bodies,
W87-02862 2E

WALLA WALLA
Mill Creek Channel, Walla Walla, Washington: Hydraulic Model Investigation,
W87-03335 8B

WARM SPRINGS DAM
Water Quality Outlet Warm Springs Dam,
W87-03232 5G

WARRI RIVER
Insecticides and Metals in Nigerian Surface Water - Warri River,
W87-03028 5B

WASHINGTON
Mill Creek Channel, Walla Walla, Washington: Hydraulic Model Investigation,
W87-03335 8B

WASHINGTON STATE
Modeling North Cascades Annual Runoff Distribution Using Drainage Basin Elevation Distribution,
W87-02627 2E

Arsenic Distributions in Porewaters and Sediments of Puget Sound, Lake Washington, the Washington Coast and Saanich Inlet, B.C.,
W87-03133 5B

WASTE CHLORIDE
Field Validation of the Contaminant Transport Model, FEMA,
W87-03089 5B

WASTE DISPOSAL
Indiana Waste Days Beyond Expectations,
W87-02757 5G

Human Viruses in Sediments, Sludges, and Soils,
W87-02768 5B

Constructing a Better Environment,
W87-03126 5G

Evaluation of the Factors Governing the Mobility of Dredged Material Placed at Open Water Disposal Sites,
W87-03252 5E

Partial Review of Dredged Material Disposal Techniques,
W87-03259 5E

Selection and Management of a New Orlean Dredged Material Disposal Site at Coos Bay, Oregon, USA, to Receive Contaminated Dredged Material,
W87-03263 5E

Progressive Trenching Using a Scraper Digger,
W87-03268 5E

WASTE MANAGEMENT
Finding Uses for Sludge,
W87-02641 5E

Indiana Waste Days Beyond Expectations,
W87-02757 5G

WASTE RECOVERY
Mixed-Culture Microbial Protein from Waste Sulfite Pulping Liquor II: Its Production on a Pilot-Plant Scale and Use in Animal Feed,
W87-03132 5E

WASTE TREATMENT
Identification of Promising Concepts for Treatment of Contaminated Sediments,
W87-03256 5D

WASTER TREATMENT
Humic Acid Interference with Virus Recovery by Electropositive Microporous Filters,
W87-02900 5A

WASTEWATER
Concentration of Seeded and Naturally Occurring Enteroviruses from Waters of Varying Quality by Hollow Fiber Ultrafiltration,
W87-02648 5A

Detection of Indigenous Enteric Viruses in Raw Sewage Effluents of the City of Athens, Greece, during a Two Year Survey,
W87-02659 5B

Readily Biodegradable Fraction of Sewage: Its Influence on Phosphorus Removal and Measurement,
W87-02738 5D

New Strategies for the Isolation of Microorganisms Responsible for Phosphate Accumulation,
W87-02740 5D

Anaerobic Treatment of Coke Plant Waste Water,
W87-02783 5D

Impact of Chemically Contaminated Sewage Sludge on the Collard Arthropod Community,
W87-03081 5C

WASTEWATER ANALYSIS
Flow Injection Analysis of Chloride in Tap and Sewage Water Using Ion-Selective Electrode Detection,
W87-02798 5A

Preservation of Traces of Chromium(VI) in Water and Waste Water Samples,
W87-02804 5A

Method for Determining Virus Inactivation During Sludge Treatment Processes,
W87-02898 5A

Indirect Atomic Absorption Determination of Anionic Surfactants in Wastewaters by Flow Injection Continuous Liquid-Liquid Extraction,
W87-03048 5A

Spectrophotometric Determination of Chromium in Waste Water and Soil,
W87-03052 5A

HPLC Anion Exclusion Method for Fluoride Determinations in Complex Effluents,
W87-03094 5A

WASTEWATER DISPOSAL
Human Viruses in Sediments, Sludges, and Soils,
W87-02768 5B

Soil Potential Ratings for Onsite Wastewater Disposal,
W87-02860 5E

Hazardout Waste Disposal: What Are the Options,
W87-03015 5E

Wastewater Engineering Design for Unsewered Areas,
W87-03339 5E

WASTEWATER DIVERSION
Validation of a Prognosis Based Upon a Eutrophication Model,
W87-02602 5C

WASTEWATER FACILITIES
Estimation of Wastewater Treatment Costs: Evaluation of the CAPDET Model for Canadian Conditions,
W87-02670 5D

Biological Phosphorus and Nitrogen Removal at an Experimental Full Scale Plant in the U.K.,
W87-02750 5D

Assessment of Odorous Emissions from Sewage Pumpstations,
W87-03029 5D

Professional Tank Cleaning Can Make a Difference,
W87-03080 5D

WASTEWATER IRRIGATION
High Concentration of Solutes at the Upper Part of the Saturated Zone (Water Table) of a Deep Aquifer Under Sewage-Irrigated Land,
W87-02677 2F

Trickle Irrigation of Wheat Applying Renovated Wastewater,
W87-02938 3F

Problems of Using Wastewater on Vegetable Crops,
W87-02954 3C

Trickle Irrigation System for Recycling Residential Wastewater on Fruit Trees,
W87-02955 3C

Interactive Effects of Sewage Effluent Irrigation and Supplemental Fertilization on Container-Grown Trees,
W87-02958 3C

Microbial Aspects of Wastewater Reuse for Irrigation,
W87-03129 3C

WASTEWATER LAGOONS
Innovative Lagoon Liner Pays Off,
W87-03078 5D

WASTEWATER MANAGEMENT
Soil Potential Ratings for Onsite Wastewater Disposal,
W87-02860 5E

WASTEWATER RENOVATION
Trickle Irrigation of Wheat Applying Renovated Wastewater,
W87-02938 3F

WASTEWATER TREATMENT
Effect of Seawater on Nitrification by Attached Biofilm,
W87-02603 5D

WASTEWATER TREATMENT

Slow Sand Filtration: Influences of Selected Process Variables,
W87-02611 5F

Effect of Influent Phosphorus Reductions on Great Lakes Sewage Treatment Costs,
W87-02630 5D

Virus Removal by Activated Sludge Treatment,
W87-02658 5D

Bacteria and Viruses in Aerobically Digested Sludge: Influence of Physical and Chemical Treatments on Survival and Association with Flocs under Laboratory Conditions,
W87-02660 5D

Virus Inactivating Effect of Anaerobic Mesophilic Digestion of Municipal Sludge With or Without Different Preceding Types of Treatment,
W87-02661 5D

Electrofocusing of Viruses and Sensitivity to Disinfection,
W87-02664 5D

Behaviour of Coliphages in Oxidation Ponds,
W87-02666 5D

Estimation of Wastewater Treatment Costs: Evaluation of the CAPDET Model for Canadian Conditions,
W87-02670 5D

Design Factors for the Scouring of Deposited Materials in Water and Wastewater Treatment Systems,
W87-02674 5F

Microbial Polymers in the Aquatic Environment-I: Production by Activated Sludge Microorganisms under Different Conditions,
W87-02694 5D

Microbial Polymers in the Aquatic Environment-II: Isolation from Biologically Non-purified and Purified Municipal Waste Water and Analysis,
W87-02695 5D

Seawater Induced Algal Flocculation,
W87-02703 5D

Starch Waste Treatment by the Activated Sludge System,
W87-02705 5D

Enterovirus Removal from Sewage: The Effectiveness of Four Different Treatment Plants,
W87-02706 5D

Effects of Cyanide on the Methanogenic Degradation of Phenolic Compounds,
W87-02709 5D

Improved Method for Recovery of Enteric Viruses from Wastewater Sludges,
W87-02710 5A

Behaviour of Intracellular Polyphosphate in the Biological Phosphate Removal Process,
W87-02735 5D

Polyphosphate Kinase Activity during Phosphate Uptake by Bacteria,
W87-02736 5D

Kinetics of Biological Phosphorus Release,
W87-02737 5D

Readily Biodegradable Fraction of Sewage: Its Influence on Phosphorus Removal and Measurement,
W87-02738 5D

Interaction of Different Groups of Micro-Organisms in Biological Phosphate Removal,
W87-02739 5D

New Strategies for the Isolation of Microorganisms Responsible for Phosphate Accumulation,
W87-02740 5D

Phosphorus Uptake by Klebsiella pneumoniae and Acinetobacter calcoaceticus,
W87-02741 5D

Some Physiological Characteristics of Acinetobacter spp. Accumulating Large Amounts of Phosphate,
W87-02742 5D

Role of Bacterial Phosphate Metabolism in Enhanced Phosphorus Removal from the Activated Sludge Process,
W87-02743 5D

Aut-Ecological Study of Acinetobacter in Activated Sludge,
W87-02744 5D

Exchange of Organics, Phosphate and Cations between Sludge and Water in Biological Phosphorus and Nitrogen Removal Processes,
W87-02745 5D

Biological Phosphorus Removal in Combination with Simultaneous Precipitation,
W87-02746 5D

Phosphorus Removal at Low Sludge Loadings,
W87-02747 5D

Factors Affecting Biological Removal of Phosphorus,
W87-02748 5D

Importance of the Acidogenic Microflora in Biological Phosphorus Removal,
W87-02749 5D

Biological Phosphorus and Nitrogen Removal at an Experimental Full Scale Plant in the U.K.,
W87-02750 5D

Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-02751 5D

Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial Wastewater Reuse and Priority Pollutant Removal,
W87-02753 5D

Anaerobic Treatment of Coke Plant Waste Water,
W87-02783 5D

$5.00, 1-Minute Effluent Quality Tester,
W87-02814 7B

Biological Phosphorus Removal: A Technology Evaluation,
W87-02820 5D

Nutrient Transformation in Retention/Detention Ponds Receiving Highway Runoff,
W87-02821 5D

Single-sludge Nitrogen Removal: Modeling and Experimental Results,
W87-02823 5D

Waterford Treatment Plant - A Small Town Lagoon System,
W87-02834 5D

Measuring Sludge Concentration and Quality,
W87-02835 5D

Operator's Guide to Protozoa and their Role in the Activated Sludge Process,
W87-02903 5D

Adapting Industrial Approaches to Municipal Wastewater Treatment Problems,
W87-02905 5D

Dual-use Filters Keep Wet-weather Flows Under Control,
W87-02926 5D

Indirect Atomic Absorption Determination of Anionic Surfactants in Wastewaters by Flow Injection Continuous Liquid-Liquid Extraction,
W87-03048 5A

Effect of Effluent Recirculation on the Performance of a Two Stage Anaerobic Process,
W87-03088 5D

Planning and Technology in Sanitary and Environmental Engineering,
W87-03098 6A

Dewatering of Bottom Sediments,
W87-03261 2J

Wastewater Treatment by Soil,
W87-03264 5D

Wastewater Engineering Design for Unsewered Areas,
W87-03339 5E

WASTEWATER TREATMENT *ADSORPTION

Application of Aluminas in Water Treatment,
W87-02752 5D

WASTEWATER TREATMENT. *CHLOROFORM

Effects of Chloroform Toxicity on Methane Fermentation,
W87-02704 5D

WASTEWATER TREATMENT FACILITIES

Effect of Effluent Recirculation on the Performance of a Two Stage Anaerobic Process,
W87-03088 5D

Cogen System Fires 100% Untreated Digester Gas,
W87-03116 5D

Getting Your Money's Worth from Computer Based Control Systems - Part 1,
W87-03120 5D

Pump Station's Cost Reduced Dramatically,
W87-03121 5D

Flow Equalizing Saves Time and Money,
W87-03124 5D

WATER ANALYSIS

Concentration of Seeded and Naturally Occurring Enteroviruses from Waters of Varying Quality by Hollow Fiber Ultrafiltration,
W87-02648 5A

Concentration of Viruses from Water Using Pig Erythrocyte Ghost Cells,
W87-02650 5A

Analysis of Tap Water for Viruses: Results of a Survey,
W87-02652 5A

Some Experimental Discussion of Accuracies in Quantitative Virus Assessment for Water Supply,
W87-02656 5A

Interactions between Biotic and Abiotic Factors and Viruses in a Water System,
W87-02657 5B

Microbial Polymers in the Aquatic Environment-II: Isolation from Biologically Non-purified and Purified Municipal Waste Water and Analysis,
W87-02695 5D

Microbial Polymers in the Aquatic Environment-III: Isolation from River, Potable and Underground Water and Analysis,
W87-02696 5B

Membrane Filtration Enumeration of Faecal Clostridia and Clostridium Perfringens in Water,
W87-02701 5A

Automated Prevalve Dilution in Flow-Injection Analysis: The Automated Determination of Chloride in Surface, Ground and Domestic Water,
W87-02793 5A

Determination of Lead, Cadmium and Thallium in Water Samples at ppb and ppt Levels by Isotope Dilution Mass Spectrometry, (Bestimmung von Blei, Cadmium und Thallium in Wasserproben im ppb- und ppt-Bereich durch massenspektrometrische Isotopenverdunnungsanalyse),
W87-02795 5A

Determination of Traces of Tin in Aqueous Matrices by Voltammetry and Atomic Absorption Spectrometry, (Bestimmung von Zinnspuren in wassrigen Matrices mit Voltammetrie und Atomabsorptionsspektrometrie),
W87-02796 5A

Trace Determination of Chromium in Various Water Types by Adsorption Differential Pulse Voltammetry,
W87-02797 5A

Flow Injection Analysis of Chloride in Tap and Sewage Water Using Ion-Selective Electrode Detection,
W87-02798 5A

Multielement Trace Preconcentration from Water on Activated Carbon for the Sample Pretreatment for Atomic Spectroscopy (Flame-AAS, ICP/OES), (Multielement-Spurenanreicherung aus Wassern an Aktivkohle zur Probenvorbereitung fur die Atomspektroskopie (Flammen-AAS, ICP/OES)),
W87-02799 5A

Selective Preconcentration of Copper from Aqueous Solution by Using Kerateine Gel,
W87-02802 5A

Investigations on the Application of the Ion-Exchanger SRAFION NMRR for the Enrichment and Separation of Uranium and Other Trace Elements from Sea Water, (Untersuchungen uber die Verwendbarkeit des Ionenaustauschers SRAFION NMRR zur Anreicherung und Abtrennung von Uran und anderen Spurenelementen aus dem Meerwasser),
W87-02803 5A

Preservation of Traces of Chromium(VI) in Water and Waste Water Samples,
W87-02804 5A

Determination of Acrylic Acid in Aqueous Samples by Electron Capture Gas Chromatography after Extraction with Tri-n-octylphosphine Oxide and Derivatization with Pentafluorobenzyl Bromide,
W87-02818 5A

Development of a Method for Concentration of Rotavirus and Its Application to Recovery of Rotaviruses from Estuarine Waters,
W87-02896 5A

Two-Method Verification of Hydrogen Peroxide Determinations in Natural Waters,
W87-03050 5A

Halogenated Phenols in Water at Forty Canadian Potable Water Treatment Facilities,
W87-03112 5F

Tritium Corrected 14C and Atmospheric Noble Gas Corrected 4He Applied to Deduce Ages of Mixed Groundwaters: Examples from the Baden Region, Switzerland,
W87-03147 5A

Fluorometric Determination of Nitrite in Natural Waters with 3-Aminonaphthalene-1,5-disulphonic Acid by Flow-Injection Analysis,
W87-03172 5A

Determination of Organically-associated Trace Metals in Estuarine Sea-Water by Solvent Extraction and Atomic-Absorption Spectrometry,
W87-03173 5A

WATER CHEMISTRY

Effects of Water Quality Parameters on the Corrosion of Galvanized Steel,
W87-02608 5G

Speciation of Manganese in Freshwaters,
W87-03051 2K

WATER CONSERVATION

Stochastic Dominance Comparison of Water-Conserving Irrigation Strategies,
W87-02873 3F

Water Conservation and Recycling in Ornamentals Production,
W87-02957 3F

Interactive Effects of Trickle Irrigation Rates, Cultivars, and Culture on Cut Chrysanthemum,
W87-02959 3F

Estimation of Spring Wheat Spike Water Concentration and Grain Maturity from Air Temperature,
W87-02998 2I

WATER CONVEYANCE

Water and Hygiene: The Case of North Carolina Farmworkers,
W87-02756 6D

Instruments and Expertise Add Up to Good Pipe Locating,
W87-02928 8C

Drinking Water Materials: Field Observations and Methods of Investigation,
W87-03340 5F

WATER COSTS

Financial Viability and Economic Efficiency of Water Supply in Kwara State - The Case of Ilorin,
W87-03046 5F

WATER CURRENTS

Effects of Current Velocity and Light Energy on the Structure of Periphyton Assemblages in Laboratory Streams,
W87-02808 2H

Bed Friction and Dissipation in a Combined Current and Wave Motion,
W87-03210 8B

WATER DEFICIT

Methods of Inducing Water Stress in Plants,
W87-02951 2I

Remote Sensing Techniques for Assessing Water Deficits and Modeling Crop Response,
W87-02953 7B

Growth and Yield of Sunflower and Soybean Under Soil Water Deficits,
W87-02992 2I

WATER DEMAND

Long Distqance Water Rights,
W87-02637 6E

Drought and Power Production,
W87-03060 6D

Decision Support System for Local Water Management,
W87-03064 6D

Reservoir Regulation and Selective Withdrawal in Oregon,
W87-03226 6D

WATER DEPTH

Direct Solutions for Normal Depth Using the Manning Equation,
W87-02963 2E

WATER DISTRIBUTION

Assuring Accurate Model Calibration,
W87-02610 5F

Distribution of Economic Rents Arising from Subsidized Water When Land is Leased,
W87-02874 6C

Instruments and Expertise Add Up to Good Pipe Locating,
W87-02928 8C

Drinking Water Materials: Field Observations and Methods of Investigation,
W87-03340 5F

WATER DISTRIBUTION SYSTEMS

Fungi in Potable Water Distribution Systems,
W87-02614 5B

WATER EXCHANGE

Resistance of Plant Roots to Water Loss,
W87-03005 2I

WATER HAMMER

Water-hammer Diagnostic Established by A Numerical Method, (Un Diagnostic de Coup de Belier Etabli par Modele Numerique),
W87-02577 8C

WATER LAW

Ixtapa Draft Agreement Relating to the Use of Transboundary Groundwaters,
W87-02592 6E

Fishing from the Bank: Public Recreational Rights along Idaho's Rivers and Lakes,
W87-02594 6E

Colorado v. New Mexico II: Judicial Restraint in the Equitable Apportionment of Interstate Waters,
W87-02595 6E

Abstention: The Crooked Course of Colorado River,
W87-02596 6E

Long Distqance Water Rights,
W87-02637 6E

Virginia, North Carolina Wage Water-Rights Battle,
W87-02638 6E

Proceedings of the Ohio Water Law Conference.
W87-03308 6E

Ohio Water Law: The Present,
W87-03310 6E

Ohio Water Law: Analyses of Present Water Protection Strategies and Suggestions for the Future,
W87-03311 6E

State Common Law Water Rights in the Context of the Federal System,
W87-03312 6E

Ohio Water Law: Present Aspects of Ohio Water Policy,
W87-03313 6E

WATER LAW

Current State of Ohio's Water Law from a Judicial and Administrative Perspective: Case Studies and Discussion,
W87-03314 6E

Moving Toward a Coordinated Groundwater Management Approach - A Legislative Proposal,
W87-03315 6E

WATER LEVEL
Selective Withdrawal From Any Level Between Minimum Pool and Spillway Elevation at Stonewall Jackson Dam, West Virginia,
W87-03245 8A

WATER LEVEL FLUCTUATIONS
Extreme Value Theory Based on the r Largest Annual Events,
W87-03069 2L

WATER LOSS
Rate of Water Loss from Detached Leaves of Drought Resistant and Susceptible Genotypes of Cowpea,
W87-02960 2I

Resistance of Plant Roots to Water Loss,
W87-03005 2I

WATER MAINS
Water-hammer Diagnostic Established by A Numerical Method, (Un Diagnostic de Coup de Belier Etabli par Modele Numerique),
W87-02577 8C

WATER MANAGEMENT
Models for Water and Power Scheduling for the California State Water Project,
W87-02626 6A

Use of Climate Predictions to Decide a Water Management Problem,
W87-02633 6A

Managing Water for Turfgrass,
W87-03016 2I

Decision Support System for Local Water Management,
W87-03064 6D

Moving Toward a Coordinated Groundwater Management Approach - A Legislative Proposal,
W87-03315 6E

WATER POLICY
Antidegradation Policy for Preserving Surface Water Quality in Florida,
W87-02636 5G

WATER POLLUTION
Rational Allocation of Monitoring Stations in a Lake by Means of the Spline Technique,
W87-02598 7A

Failure to Detect Cytopathic Enteroviruses in Drinking Water,
W87-02654 5A

Interactions between Biotic and Abiotic Factors and Viruses in a Water System,
W87-02657 5B

Concentrations of 20 Volatile Organic Compounds in the Air and Drinking Water of 350 Residents of New Jersey Compared with Concentrations in Their Exhaled Breath,
W87-02774 5B

Monitoring Pollution,
W87-03117 5A

Influence of Accumulating Organic Sediment on the Marine Environment in Osaka Bay,
W87-03257 5C

Groundwater: Its Occurrence, Movement and Potential for Pollution,
W87-03309 2F

WATER POLLUTION CONTROL
Alternatives to the Use of Agricultural Drainage Wells,
W87-02624 4B

Containing Landfill Leaks,
W87-02639 5B

Problem of Phosphorus in France - Its Presence in Natural Waters and Biological Phosphorus Removal,
W87-02734 5G

Developing Management Guidelines for River Nitrogenous Oxygen Demand,
W87-02822 5G

Managing the Industrial/Hazardous Contributions to the Niagara River,
W87-02828 5G

Toxic Substances, Risk Management and New York State Drinking Water,
W87-02832 5B

Fertilizers Suitable for the Environment as Part of a Reorientation in Agricultural Policy,
W87-03040 5G

Management of Bottom Sediments Containing Toxic Substances.
W87-03248 5G

Legal System and Works for Preservation of the Port, Harbour, and Marine Environment in Japan,
W87-03249 5G

Plan for Protecting Illinois Groundwater.
W87-03331 6B

WATER POLLUTION EFFECTS
Effects of Four Agricultural Pesticides on Daphnia pulex, Lemna minor, and Potamogeton pectinatus,
W87-02589 5C

Detection and Health Risk Associated with Low Virus Concentration in Drinking Water,
W87-02653 5A

Absence of Acclimation to Parathion by Rainbow Trout During Sublethal Exposure,
W87-02697 5C

Avoidance-Preference Reactions of Rainbow Trout (Salmo Gairdneri) After Prolonged Exposure to Chromium(VI),
W87-02698 5C

Seasonal, Behavioral and Growth Changes of Juvenile Corbicula Fluminea Exposed to Chrysotile Asbestos,
W87-02699 5C

Primary and Secondary Stress Responses of Striped Bass (Morone saxatilis) Exposed to Benzene,
W87-02771 5C

Toxicity of Brass Dust to the Microalgae Ankistrodesmus falcatus and Selenastrum capricornutum,
W87-02778 5C

Medical Geology,
W87-02825 5C

Public Policy Implications of Toxic Chemicals in Drinking Water: A Case Study of Long Island, NY,
W87-02826 5C

Environmental Impact of Oil Spills and the Oil Industry Response,
W87-02829 5C

Asbestos in Potable Water Supplies and Attributable Risk of Gastrointestinal Cancer,
W87-02830 5C

Physiological Innocuity of Asbestos in Water,
W87-02831 5C

Health Effects of Arsenic in the Aqueous Environment,
W87-02833 5C

Effect of Metal Chelation on the Toxicity of Some Environmentally Hazardous Trace Metals to Daphnia magna,
W87-03024 5G

Decline of the Gastropod Nucella lapillus Around South-West England: Evidence for the Effect of Tributyltin from Antifouling Paints,
W87-03053 5C

Modelling the Effects of Acidic Deposition And Conifer Afforestation on Stream Acidity in the British Uplands,
W87-03068 5C

Acute and Chronic Toxicity of Nickel to Larvae of Chironomus riparis (Meigen),
W87-03083 5C

Boron Tolerance and Accumulation in the Duckweed, Lemna minor,
W87-03152 5C

Micronutrient Tolerance and Accumulation in the Duckweed, Lemna,
W87-03153 5C

Rates of Mineral Element Leaching from Leaves of Nine Plant Species from a Southern Appalachian Forest Succession Subjected to Simulated Acid Rain,
W87-03206 5C

Acid Rain: A Review of the Phenomenon in the EEC and Europe.
W87-03338 5C

WATER POLLUTION PREVENTION
Hydrometallurgy: Winning Metals with Water,
W87-02618 5G

Indiana Waste Days Beyond Expectations,
W87-02757 5G

Maryland's Phosphate Ban-History and Early Results,
W87-02819 5G

Petroleum Recovery Operations in an Urban Area,
W87-03065 5G

WATER POLLUTION SOURCES
Overview of PCB Pollution and its Behavior in Seine River, (Apercu sur la Pollution par les P.C.B. (Polychlorobiphenyles) en Seine, et son Comportement),
W87-02564 5B

Rational Allocation of Monitoring Stations in a Lake by Means of the Spline Technique,
W87-02598 7A

Lead Dissolution From Soldered Joints,
W87-02607 5B

Alternatives to the Use of Agricultural Drainage Wells,
W87-02624 4B

Unsaturated Flow Through Solid Waste Landfills: Model and Sensitivity Analysis,
W87-02628 5B

Red Alder Leaf Litter and Streamwater Quality in Western Oregon,
W87-02631 5B

Containing Landfill Leaks,
W87-02639 5B

Viruses and Bacteria in a Chalk Well,
W87-02655 5B

Interactions between Biotic and Abiotic Factors and Viruses in a Water System,
W87-02657 5B

Examination of the Penetration of Enteric Viruses in Soils under Simulated Conditions in the Laboratory,
W87-02663 5B

Deposition of Atmospheric Trace Metals in Northern Sweden as Measured in the Snowpack,
W87-02720 5B

Lake Acidification and the Land-Use Hypothesis: A Mid-Post-Glacial Analogue,
W87-02810 2K

Groundwater Contamination with Synthetic Organic Compounds and Pesticides in Suffolk County,
W87-02827 5B

Managing the Industrial/Hazardous Contributions to the Niagara River,
W87-02828 5G

Environmental Impact of Oil Spills and the Oil Industry Response,
W87-02829 5C

Physiological Innocuity of Asbestos in Water,
W87-02831 5C

Toxic Substances, Risk Management and New York State Drinking Water,
W87-02832 5B

Health Effects of Arsenic in the Aqueous Environment,
W87-02833 5C

Modeling Leachate Production from Municipal Landfills,
W87-02883 5B

Use of Geostatistics to Predict Virus Decay Rates for Determination of Septic Tank Setback Distances,
W87-02895 5B

Development of a Method for Concentration of Rotavirus and Its Application to Recovery of Rotaviruses from Estuarine Waters,
W87-02896 5A

Under EPA Scrutiny: Underground Storage Tanks,
W87-03021 5B

Effect of Oxygen on Release and Uptake of Cobalt, Manganese, Iron and Phosphate at the Sediment-Water Interface,
W87-03143 5B

Benthic Fluxes of Cadmium, Copper, Nickel, Zinc and Lead in the Coastal Environment,
W87-03144 5B

Nonpoint Source Loading of Phenolic Acids from Decomposing Crop Residue,
W87-03161 5B

Environmental Conservation in the Port of Maizuru,
W87-03269 5B

Solute Yield From a Glacierized High Mountain Basin,
W87-03276 5B

Stream Solute Sources and Variations in a Temperate Granite Drainage Basin,
W87-03296 5B

Nitrate Load/Discharge Relationships and Nitrate Load Trends in Danish Rivers,
W87-03302 5B

Acid Rain: A Review of the Phenomenon in the EEC and Europe.
W87-03338 5C

Drinking Water Materials: Field Observations and Methods of Investigation,
W87-03340 5F

WATER POLLUTION TREATMENT

In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-02754 5G

Effect of Metal Chelation on the Toxicity of Some Environmentally Hazardous Trace Metals to Daphnia magna,
W87-03024 5G

Identification of Promising Concepts for Treatment of Contaminated Sediments,
W87-03256 5D

Purification of Nho River by the Gravel Contact Method,
W87-03266 5G

WATER POTENTIALS

Effect of Rootstock on Apple (Malus domestica) Tree Water Relations,
W87-03056 2I

WATER QUALITY

Determination of Pollution and Eutrophic Conditions of Sapanca Lake (Turkey),
W87-02587 5B

Trihalomethane Levels in Chlorinated Michigan Drinking Water,
W87-02605 5F

Fungi in Potable Water Distribution Systems,
W87-02614 5B

Impacts of Water Quality Improvement on Site Visitation: A Probabilistic Modeling Approach,
W87-02622 4D

Characterization of Water Using Combined Sewer Overflows, (Caracterization des Eaux Usees de Debordements de Reseau Unitaire),
W87-02672 5B

Design Factors for the Scouring of Deposited Materials in Water and Wastewater Treatment Systems,
W87-02674 5F

Wave Movement and Water-Quality Variations During a Controlled Release from Kielder Reservoir, North Tyne River, U. K.,
W87-02681 2E

Salmonellae and Pollution Indicator Bacteria in Municipal and Food Processing Effluents and the Cornwallis River,
W87-02815 5D

Evolution in Space and Time of an Alluvial Aquifer under the Effect of an Exceptional Multi-Year Drought (Mediterranean Shore, Herault, France) (Evolution Spatio-Temporelle d'un Aquifere Alluvial sous l'Effet d'une Secheresse Pluriannuelle Exceptionnelle (Littoral Mediterraneen, Herault, France)),
W87-02838 2F

Use of Geostatistics to Predict Virus Decay Rates for Determination of Septic Tank Setback Distances,
W87-02895 5B

Voter Reactions to the 1976 Water Development and Quality Referenda in Texas,
W87-02944 6E

Box Model for Prediction of Water Quality in Eutrophic Lakes,
W87-02972 2H

Chemistry of Tap Water in Sri Lanka - Implications on Health,
W87-03026 5F

Bloomington Dam, Potomac River Water Quality Outlet,
W87-03231 5G

Environmental and Water Quality Operational Studies (EWQOS) - Application to Lake Restoration,
W87-03271 5G

Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships.
W87-03272 5B

Trend Analysis of Water Quality in the Sabarmati River at Ahmedabad for a Decade (1969-1978),
W87-03278 5G

Multivariate Analysis of Quality Parameters to Determine the Chemical Transport in Rivers,
W87-03280 5B

Statistical Analysis of the Relationship Between Water Quality Parameters and Discharge at Eight Stations on the Rhine from 1959 to 1974 (Analyse Statistique des Relations Liant les Parametres de Qualite d'Eau et le Debit du Rhin en Huit Stations de 1959 a 1974),
W87-03282 5G

Regional Analysis of Water Quality in Major Streams of the United States,
W87-03284 5G

Stream Solute Behaviour in the River Exe Basin, Devon, UK,
W87-03286 5B

Biogeochemical Controls on River Water Quality in a Forested Drainage Basin, Warwickshire, UK,
W87-03292 2E

Effects of Hydraulic Projects and Their Management on Water Quality,
W87-03297 6G

Dissolved and Suspended Loads of the Regulated River Nidda in the Rhine-Main Area,
W87-03299 5B

Numerical Simulation Relating Land Uses Within a Drainage Basin to the Downstream River Water Quality (Simulation Numerique de l'Influence des Pratiques Culturales dans un BAsin Versant sur la Qualite des Eaux a Son Exutoire),
W87-03300 6G

Influence of Catastrophic Floods on Water Quality as Recorded in the Sediments of Blagdon Lake, England,
W87-03306 2H

Comparison of Water Quality in Drainage Basins Under Agricultural and Forest Land Use,
W87-03307 2E

Groundwater: Its Occurrence, Movement and Potential for Pollution,
W87-03309 2F

Statistical Methods for Reservoir Water Quality Investigations,
W87-03322 7C

WATER QUALITY

Measuring Suspended Sediment in Small Mountain Streams,
W87-03324 5A

WATER QUALITY CONTROL

Effects of Water Quality Parameters on the Corrosion of Galvanized Steel,
W87-02608 5G

Managing an Unfiltered Water Supply,
W87-02609 5F

Chlorination to Prevent and Control Waterborne Diseases,
W87-02613 5F

Efficient Method of Applying Aluminum Salts for Sediment Phosphorus Inactivation in Lakes,
W87-02635 5G

Antidegradation Policy for Preserving Surface Water Quality in Florida,
W87-02636 5G

Cost of Pure Water,
W87-02642 5G

Maryland's Phosphate Ban-History and Early Results,
W87-02819 5G

Developing Management Guidelines for River Nitrogenous Oxygen Demand,
W87-02822 5G

Managing the Industrial/Hazardous Contributions to the Niagara River,
W87-02828 5G

Toxic Substances, Risk Management and New York State Drinking Water,
W87-02832 5B

Assessment of the Impact of Eutrophication Control Measures on South African Impoundments,
W87-02973 5G

Cost Analysis of the Adverse Effects of Algal Growth in Water Bodies on Drinking Water Supply,
W87-02977 5F

Selective Withdrawal: Basic Concepts,
W87-03222 8B

Hydraulic Design of the Selective Withdrawal Structures of the Lost Creek Dam,
W87-03223 8A

Hydraulic Design of the Selective Withdrawal Structures of the Applegate Dam,
W87-03224 8A

Hydraulic Design of the Selective Withdrawal Structures at the Elk Creek Dam,
W87-03225 8A

Operation of Selective Withdrawal Facilities: Libby Dam, Montana,
W87-03227 5C

Alternatives for Improving Reservoir Water Quality,
W87-03228 5G

Review of Selective Withdrawal Performance in the Fort Worth District,
W87-03229 6B

Modeling of Selective Withdrawal Intake Structures,
W87-03230 5G

Bloomington Dam, Potomac River Water Quality Outlet,
W87-03231 5G

Water Quality Outlet Warm Springs Dam,
W87-03232 5G

Hydraulic Design: Bloomington Lake and F. E. Walter Dam Project's Selective Withdrawal Structures,
W87-03233 8A

Determination of Selective Withdrawal System Capacity for Intake Tower Design,
W87-03234 5G

SELECT: The Numerical Model,
W87-03235 5G

Design of Selective Withdrawal Intake Structures,
W87-03237 8A

Operational Tools: Selective Withdrawal and Daily Operational Strategy,
W87-03238 5G

Operational Tools: Optimal Control of Reservoir Water Quality,
W87-03239 5G

Field Measurements at Intake Structures,
W87-03240 8B

Selective Withdrawal Needs for Lake Greeson Arkansas Intake Structure,
W87-03242 5G

Selective Withdrawal Structure Operation Experiences in ORD,
W87-03243 8A

Overview of Pittsburgh District Selective Withdrawal Operation Experiences,
W87-03244 5G

Selective Withdrawal From Any Level Between Minimum Pool and Spillway Elevation at Stonewall Jackson Dam, West Virginia,
W87-03245 8A

Selective Experiences: Alias Withdrawal Pains,
W87-03246 6B

Design and Performance of Skimming Weirs in the Kansas City District,
W87-03247 8A

Management of Bottom Sediments Containing Toxic Substances.
W87-03248 5G

Legal System and Works for Preservation of the Port, Harbour, and Marine Environment in Japan,
W87-03249 5G

In Situ Stream Water Clarifying Tests,
W87-03265 5G

Role of Detention Basins for Stormwater Quality Control,
W87-03301 5G

Principles Underlying the Development of Water Quality Monitoring Systems in Hungary,
W87-03303 7A

Real Time Water Quality Forecasting Models Based on the Water Quantity/Quality Relationship,
W87-03304 5A

Current State of Ohio's Water Law from a Judicial and Administrative Perspective: Case Studies and Discussion,
W87-03314 6E

Effectiveness of Capping in Isolating Dutch Kills Sediment from Biota and the Overlying Water,
W87-03332 5G

Drinking Water Materials: Field Observations and Methods of Investigation,
W87-03340 5F

WATER QUALITY MANAGEMENT

Detection of Rotavirus in Treated Drinking Water,
W87-02643 5B

Some Experimental Discussion of Accuracies in Quantitative Virus Assessment for Water Supply,
W87-02656 5A

Problem of Phosphorus in France - Its Presence in Natural Waters and Biological Phosphorus Removal,
W87-02734 5G

In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-02754 5G

$5.00, 1-Minute Effluent Quality Tester,
W87-02814 7B

Environmental and Water Quality Operational Studies (EWQOS) - Application to Lake Restoration,
W87-03271 5G

WATER QUALITY MODELS

Diel Variation of In-stream Nitrification,
W87-02711 5B

WATER QUALITY PROTECTION

Plan for Protecting Illinois Groundwater.
W87-03331 6B

WATER QUALITY STANDARDS

Toxicity Tests of Aquatic Pollutants by Using Common Duckweed,
W87-02582 5A

Detection of Rotavirus in Treated Drinking Water,
W87-02643 5B

WATER RATES

Financial Viability and Economic Efficiency of Water Supply in Kwara State - The Case of Ilorin,
W87-03046 5F

WATER REQUIREMENTS

Review and Analysis of Methods for Quantifying Instream Flow Requirements,
W87-02933 6D

WATER RESOURCES DEVELOPMENT

Water Supply in Developing Countries: Improving on Current Practice,
W87-02784 5G

Pskem Hydro Development on the Pskem River,
W87-02870 8A

Voter Reactions to the 1976 Water Development and Quality Referenda in Texas,
W87-02944 6E

Complexity in Columbia River Systems Modeling,
W87-03059 6B

General Impact of Aswan High Dam,
W87-03066 6G

Existence Values and Normative Economics: Implications for Valuing Water Resources,
W87-03188 6B

Plan for Protecting Illinois Groundwater.
W87-03331 6B

WATER RESOURCES INSTITUTES

History of the Federal-State Cooperative Water Resources Research Institute Program,
W87-02632 9D

WATER REUSE
Energy Recovery Small Hydro Plants on the Rhone River. The First Months of Operation of Champagneux Power Plant and the Sault-Brenaz Project, (Les Petites Centrales de Recuperation sur le Rhone. Les Premiers Mois d' Exploitation de la Centrale de Champagneux et le Project de Sault-Brenaz),
W87-02575 8C

Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial Wastewater Reuse and Priority Pollutant Removal,
W87-02753 5D

Recycling Irrigation Runoff on Container Ornamentals,
W87-02956 3F

WATER RIGHTS
Water Supply in the Northeast: A Study in Regulatory Failure,
W87-02590 6E

Ixtapa Draft Agreement Relating to the Use of Transboundary Groundwaters,
W87-02592 6E

Fishing from the Bank: Public Recreational Rights along Idaho's Rivers and Lakes,
W87-02594 6E

Long Distqance Water Rights,
W87-02637 6E

Virginia, North Carolina Wage Water-Rights Battle,
W87-02638 6E

Ohio Water Law: Analyses of Present Water Protection Strategies and Suggestions for the Future,
W87-03311 6E

State Common Law Water Rights in the Context of the Federal System,
W87-03312 6E

WATER SAMPLING
Determination of Pollution and Eutrophic Conditions of Sapanca Lake (Turkey),
W87-02587 5B

Investigations on the Application of the Ion-Exchanger SRAFION NMRR for the Enrichment and Separation of Uranium and Other Trace Elements from Sea Water, (Untersuchungen uber die Verwendbarkeit des Ionenaustauschers SRAFION NMRR zur Anreicherung und Abtrennung von Uran und anderen Spurenelementen aus dem Meerwasser),
W87-02803 5A

Preservation of Traces of Chromium(VI) in Water and Waste Water Samples,
W87-02804 5A

Evaluation of Methods for Preservation of Water Samples for Nutrient Analysis,
W87-03030 5A

WATER SHORTAGE
Managing Water for Turfgrass,
W87-03016 2I

Minimizing the Cost of Coping with Droughts: Springfield, Illinois,
W87-03057 6D

Drought and Power Production,
W87-03060 6D

WATER STORAGE
Air Encapsulation: II. Profile Water Storage and Shallow Water Table Fluctuations,
W87-02916 2F

Wheat Residue Management Effects on Soil Water Storage and Corn Production,
W87-02924 3F

WATER STRESS
Methods of Inducing Water Stress in Plants,
W87-02951 2I

Integration of Water Stress in Fruit Trees,
W87-02952 2I

Root Systems in Relation to Stress Tolerance,
W87-02961 2I

Differential Sensitivity of Turfgrass Organs to Water Stress,
W87-02962 2I

Use of Portable Rainout Shelters to Induce Water Stress,
W87-02991 2I

Kleingrass Yield and Quality Under Three Irrigation Regimes When Harvested at Anthesis,
W87-02993 3F

Interactive Effects of Nitrogen and Water Stresses on Water Relations of Field-Grown Corn Leaves,
W87-02994 2I

Yield and Physiological Responses of Potatoes to Deficit, High Frequency Sprinkler Irrigation,
W87-02997 3F

Gas Exchange of Field-Grown Soybean Under Drought,
W87-02999 2I

Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-03010 2I

Effect of Short-term Water Stress on Leaf Gas Exchange Processes and Plant Water Potential in Schefflera,
W87-03104 2I

Water Deficit During Panicle Development in Pearl Millet: Yield Compensation by Tillers,
W87-03157 2I

Water or Salt Stress Increases Infectivity of Erysiphe pisi Conidia Taken from Stressed Plants,
W87-03175 5C

Triadimefon Protects Bean Plants from Water Stress through its Effects on Abscisic Acid,
W87-03202 2I

Accumulation and Turnover of Abscisic Acid in Osmotically Stressed Cotton Leaf Tissue in Relation to Temperature,
W87-03216 2I

WATER SUPPLY
Managing an Unfiltered Water Supply,
W87-02609 5F

Water and Hygiene: The Case of North Carolina Farmworkers,
W87-02756 6D

Water Supply in Developing Countries: Improving on Current Practice,
W87-02784 5G

Distribution of Economic Rents Arising from Subsidized Water When Land is Leased,
W87-02874 6C

Phenotypic Characteristics of Coliform and Noncoliform Bacteria from a Public Water Supply Compared with Regional and National Clinical Species,
W87-02894 5A

Water and the Third Millennium,
W87-03044 5F

Real Time Water Quality Forecasting Models Based on the Water Quantity/Quality Relationship,
W87-03304 5A

WATER SUPPLY DEVELOPMENT
Minimizing the Cost of Coping with Droughts: Springfield, Illinois,
W87-03057 6D

WATER SUPPLY SYSTEMS
Analysis and Cartographical Approach to the Regional Water Utilization System in the Yodo River Basin,
W87-02978 6D

County's Search for Long-Term Water Supply Pays Off,
W87-03119 5F

WATER SURFACE PROFILES
Kinematic Overland Flow: Generalization of Rose's Approximate Solution,
W87-02841 2E

WATER TABLE
Air Encapsulation: II. Profile Water Storage and Shallow Water Table Fluctuations,
W87-02916 2F

WATER TABLE DECLINE
New Analogue Computer for the Study of Pumping Tests under Falling Water-Table Conditions,
W87-02854 7B

WATER TABLE PROFILES
Air Encapsulation: II. Profile Water Storage and Shallow Water Table Fluctuations,
W87-02916 2F

WATER TANKS
Lessons from Field Experience with Rainwater Collection Systems in Africa and Asia,
W87-03042 5F

WATER TEMPERATURE
Mathematical Prediction of Thermal Stratification of Lake Ostrovo (Vegoritis), Greece,
W87-03198 2H

WATER TREATMENT
Slow Sand Filtration: Influences of Selected Process Variables,
W87-02611 5F

Chlorination to Prevent and Control Waterborne Diseases,
W87-02613 5F

Detection of Rotavirus in Treated Drinking Water,
W87-02643 5B

Rotavirus Survival in Raw and Treated Waters and Its Health Implications,
W87-02644 5G

Electrofocusing of Viruses and Sensitivity to Disinfection,
W87-02664 5D

Study of Indigenous Virus Removal at Different Stages in a Drinking Water Plant Treating River Water,
W87-02665 5F

Design Factors for the Scouring of Deposited Materials in Water and Wastewater Treatment Systems,
W87-02674 5F

WATER TREATMENT

Radiation Induced Decomposition of Some Chlorinated Methanes in Water,
W87-02702 5D

Innovative Technique for Determining Velocity Gradient in Coagulation--Flocculation Process,
W87-02708 5F

Application of Aluminas in Water Treatment,
W87-02752 5D

Use of Ultraviolet Light in the Treatment of Water in Public Spas and Hot Tubs,
W87-02755 5F

Hydraulics of Rectangular Clarifiers,
W87-02886 8B

Water and the Third Millennium,
W87-03044 5F

In Situ Stream Water Clarifying Tests,
W87-03265 5G

Drinking Water Materials: Field Observations and Methods of Investigation,
W87-03340 5F

WATER TREATMENT FACILITIES

Study of Indigenous Virus Removal at Different Stages in a Drinking Water Plant Treating River Water,
W87-02665 5F

Pump Station Gets Navy Discharge and New Life as Civilian,
W87-02925 5F

Reverse Osmosis Can Be Cost Effective,
W87-03079 3A

Halogenated Phenols in Water at Forty Canadian Potable Water Treatment Facilities,
W87-03112 5F

WATER TREATMENT PROCESS

Practical Direct Plaque Assay for Coliphages in 100-ml Samples of Drinking Water,
W87-02890 5A

WATER USE

Water Use in Urban Korea,
W87-02617 6D

Evaluation of Weekly and Monthly Time Series Forecasts of Municipal Water Use,
W87-02629 6A

Water and Hygiene: The Case of North Carolina Farmworkers,
W87-02756 6D

Root Distribution and Water Uptake Patterns of Maize Cultivars Field-Grown under Differential Irrigation,
W87-02817 2I

Profile Modification and Irrigation Effects on Yield and Water Use of Wheat,
W87-02920 3F

Techniques for Water-Use Measurements of Crop Plants,
W87-02949 7B

Soil Compaction and Moisture Stress Preconditioning in Kentucky Bluegrass. I. Soil Aeration, Water Use, and Root Responses,
W87-02982 2G

Dryland Grain Sorghum Water Use, Light Interception, and Growth Response to Planting Geometry,
W87-03008 2I

Turfgrass Water Use Rates,
W87-03014 2I

Controlling Turfgrass Water Use Rates,
W87-03017 2I

Water Supply of Varanasi - The Oldest City of India,
W87-03039 5F

Decision Support System for Local Water Management,
W87-03064 6D

Structural Change Implications for Industrial Water Use,
W87-03190 6D

WATER USE EFFICIENCY

Distribute Water Effectively,
W87-02760 3F

Profile Modification and Irrigation Effects on Yield and Water Use of Wheat,
W87-02920 3F

Water Distribution Profiles for Sprinklers,
W87-02946 3F

Sprinkler Spacing Patterns,
W87-02947 3F

Drip and Minis, in the Commercial Landscape,
W87-02948 3F

Recycling Irrigation Runoff on Container Ornamentals,
W87-02956 3F

Interactive Effects of Trickle Irrigation Rates, Cultivars, and Culture on Cut Chrysanthemum,
W87-02959 3F

Water Use Efficiency in Soybean Pubescence Density Isolines-A Calculation Procedure for Estimating Daily Values,
W87-03000 2I

Effects of Carbon Dioxide Enrichment and Soil Water on Maize,
W87-03002 2I

Effect of Deep Tillage and Controlled Traffic on Root Growth, Water-Use Efficiency and Yield of Irrigated Maize and Wheat,
W87-03165 3F

WATER VAPOR

Procedure to Select Drought-Tolerant Sorghum and Millet Genotypes Using Canopy Temperature and Vapor Pressure Deficit,
W87-03001 2I

WATER WELLS

Viruses and Bacteria in a Chalk Well,
W87-02655 5B

WATERBORNE DISEASES

Waterborne Viral Gastroenteritis,
W87-02612 5C

Chlorination to Prevent and Control Waterborne Diseases,
W87-02613 5F

WATERFORD

Waterford Treatment Plant - A Small Town Lagoon System,
W87-02834 5D

WATERHAMMER PRESSURE

Waterhammer Pressure Compensation in Turbine Regulating Systems,
W87-02690 8C

WATERLOGGING

Response to Waterlogging and Differing Sensitivity to Divalent Iron and Manganese in Clones of Dactylis glomerata L. Derived from Well-Drained and Poorly-Drained Soils,
W87-03095 5C

Forms of Nitrogen in Waterlogged Soils and Their Contribution to Yield and Nitrogen Uptake by Rice,
W87-03158 3C

WATERSHEDS

Watershed Modeling for Fire Management Planning in the Northern Rocky Mountains,
W87-03323 4D

WAVE ACTION

Wave Movement and Water-Quality Variations During a Controlled Release from Kielder Reservoir, North Tyne River, U. K.,
W87-02681 2E

Effect of Waves on Buoyant Jets,
W87-02964 5B

Rockfall-Induced Waves in Reservoirs,
W87-03037 8E

Bed Friction and Dissipation in a Combined Current and Wave Motion,
W87-03210 8B

Riprap Stability and Navigation Tests for the Divide-Cut Section Tennessee-Tombigbee Waterway,
W87-03317 8A

WAVE HEIGHT

Spectral and Statistical Characteristics of Shallow Water Waves,
W87-03218 8B

WAVE RUNUP

Computation of Wave Transmission Over a Shore Protecting Submerged Breakwater,
W87-03217 8B

WAVE TRANSMISSION

Computation of Wave Transmission Over a Shore Protecting Submerged Breakwater,
W87-03217 8B

WAVES

Analysis of the Velocity Field in a Boundary Layer Generated by a Water Wave, (Analyse du Champ des Vitesses dans la Couche Limite Generee par une Onde Progressive (Houle)),
W87-02790 8B

Spectral and Statistical Characteristics of Shallow Water Waves,
W87-03218 8B

WEATHER

Relationships Between Growth and Measured Weather Factors Among Contrasting Varieties of Lolium, Dactylis and Festuca Species,
W87-03100 2I

WEATHER MODIFICATION

Interim Progress Report, Volume I: SCPP Meteorological and Statistical Support for Period 1 September 1984 through 31 August 1985,
W87-03327 2B

WEATHER PATTERNS

Climatic Change, Weather Variability, and Corn Production,
W87-03006 2I

Atmospheric Inputs and River Transport of Dissolved Substances,
W87-03287 2B

WEATHERING

Groundwater Occurrences in the Hard Rock Terrains of Sri Lanka - A Case Study,
W87-03047 2F

Weathering Reactions, Water Chemistry and Denudation Rates in Drainage Basins of Different Bedrock Types: I - Sandstone and Shale,
W87-03288 2K

WEED CONTROL
Herbicides and Seeding Rate Effects on Sprinkler-Irrigated Rice,
W87-03013 2I

WEIRS
Design and Performance of Skimming Weirs in the Kansas City District,
W87-03247 8A

WELLS
Anomalous Natural Sulfate in Water Wells of the Greenbrier Group, West Virginia,
W87-02625 5B

Use of Geostatistics to Predict Virus Decay Rates for Determination of Septic Tank Setback Distances,
W87-02895 5B

WEONJU
Water Use in Urban Korea,
W87-02617 6D

WEST GERMANY
Fertilizers Suitable for the Environment as Part of a Reorientation in Agricultural Policy,
W87-03040 5G

WEST VIRGINIA
Anomalous Natural Sulfate in Water Wells of the Greenbrier Group, West Virginia,
W87-02625 5B

Selective Withdrawal From Any Level Between Minimum Pool and Spillway Elevation at Stonewall Jackson Dam, West Virginia,
W87-03245 8A

WET SPRING CONDITIONS
Department of Agriculture, Belfast (N. Ireland). Agricultural and Food Chemistry Research Div.
W87-03159 3F

WETLANDS
Environmental Gradients in Northwest Freshwater Wetlands,
W87-02615 2H

Stemming the Loss of Coastal Wetland Habitats: Jamaica as a Model for Tropical Developing Countries,
W87-03128 2L

Distribution and Standing Crop of Living and Dead Roots in Three Wetland Carex Species,
W87-03204 2H

Growth and Survival of Giant Ragweed (Ambrosia trifida L.) in a Delaware River Freshwater Tidal Wetland,
W87-03207 2H

WHEAT
Effect of Irrigation and Nitrogen Fertilizer on the Yield and Protein Content of Soft White Spring Wheat,
W87-02877 3F

Snow and Fertilizer Management for Continuous Zero-Till Spring Wheat,
W87-02879 3F

Profile Modification and Irrigation Effects on Yield and Water Use of Wheat,
W87-02920 3F

Wheat Residue Management Effects on Soil Water Storage and Corn Production,
W87-02924 3F

Trickle Irrigation of Wheat Applying Renovated Wastewater,
W87-02938 3F

Estimation of Spring Wheat Spike Water Concentration and Grain Maturity from Air Temperature,
W87-02998 2I

Changes in Spring Wheat Tillering Patterns in Response to Delayed Irrigation,
W87-03012 2I

Effect of Deep Tillage and Controlled Traffic on Root Growth, Water-Use Efficiency and Yield of Irrigated Maize and Wheat,
W87-03165 3F

WHEATON
Dual-use Filters Keep Wet-weather Flows Under Control,
W87-02926 5D

WHITEWATER DRAW
Late Quaternary Alluvial Stratigraphy of Whitewater Draw, Arizona: Implications for Regional Correlation of Fluvial Deposits in the American Southwest,
W87-03209 8E

WILD TOMATO
Potassium Utilization and Fluxes in Wild Salt-Tolerant Relatives of the Cultivated Tomato,
W87-03055 2I

WILDLAND MANAGEMENT
Wildland Management on Point Pelee, Rondeau, and Long Point Peninsulas, Lake Erie,
W87-02591 6G

WIND VELOCITY
Microclimate of an Upland Grassland,
W87-03101 2I

WINDROWING
Estimation of Spring Wheat Spike Water Concentration and Grain Maturity from Air Temperature,
W87-02998 2I

WOOD WASTES
Environmental Conservation in the Port of Maizuru,
W87-03269 5B

WOVEN PLASTIC MULCH
Effect of Woven Plastic Mulch, Herbicides, Grass Sod, and Nitrogen on 'Foch' Grapes Under Irrigation,
W87-03106 3F

YODO RIVER BASIN
Analysis and Cartographical Approach to the Regional Water Utilization System in the Yodo River Basin,
W87-02978 6D

YUGOSLAVIA
Hydrological Investigations of Dinaric Karst at the Krcic Catchment and the River Krka Springs (Yugoslavia),
W87-02845 2A

Regime of Ground Water of Semberian Aquifer,
W87-03043 2F

ZEEMAN ATOMIC ABSORPTION SPECTROSCOPY
Direct Determination of Cd, Cu and Ni in the Elbe River Estuary with Zeeman AAS and Matrix Modification (Direktbestimmung von Cd, Cu and Ni im Elbeastuar mit Hilfe der Zeeman-Atomabsorptionsspektroskopie und Matrixmodifikation),
W87-03087 5A

ZINC
Interlaboratory Comparison of Analyses for Heavy Metals in Clam Tissue,
W87-03114 5A

Flame Absorption Spectroscopic Determination of Cadmium, Copper, Iron, Lead, and Zinc in Mussels,
W87-03115 5A

Benthic Fluxes of Cadmium, Copper, Nickel, Zinc and Lead in the Coastal Environment,
W87-03144 5B

ZOOPLANKTON
Synthesis and Analysis of a Comprehensive Lake Model - With the Evaluation of Diversity of Ecosystems,
W87-02965 2H

Association Between Some Planktonic Species and Physicochemical Characteristics of the Water of Loktak Lake, Manipur, India,
W87-03025 2H

Zooplankton Fauna of Killary Harbour: The Seasonal Cycle of Abundance,
W87-03054 2L

AUTHOR INDEX

ABERLEY, R. C.
Finding Uses for Sludge,
W87-02641 5E

ABOUZAMZAM, A. M.
Effects of Soil Conditioners on Water Relationships in Soils,
W87-02910 2G

ACREMAN, M. C.
Classification of Drainage Basins According to their Physical Characteristics; An Application for Flood Frequency Analysis in Scotland,
W87-02683 2E

ADAMS, B. J.
Meteorological Data Analysis for Drainage System Design,
W87-02882 2B

ADAMS, P. W.
Red Alder Leaf Litter and Streamwater Quality in Western Oregon,
W87-02631 5B

ADAMS, S. J.
Measurements of pH versus Drop Size in Natural Rain,
W87-02811 2B

ADAMS, S. N.
Department of Agriculture, Belfast (N. Ireland). Agricultural and Food Chemistry Research Div.
W87-03159 3F

AFIFI, A. A.
Weathering Reactions, Water Chemistry and Denudation Rates in Drainage Basins of Different Bedrock Types: I - Sandstone and Shale,
W87-03288 2K

AFONIN, A. Y.
Experience of Using the Turbine-Generator Units of the Kolyma Hydroelectric Station for Idle Discharge of Water,
W87-03177 8C

AGBALIKA, F.
Study of Indigenous Virus Removal at Different Stages in a Drinking Water Plant Treating River Water,
W87-02665 5F

AGNEW, M. L.
Managing Water for Turfgrass,
W87-03016 2I

Soil Compaction and Moisture Stress Preconditioning in Kentucky Bluegrass. I. Soil Aeration, Water Use, and Root Responses,
W87-02982 2G

Soil Compaction and Moisture Stress Preconditioning in Kentucky Bluegrass. II. Stomatal Resistance, Leaf Water Potential, and Canopy Temperature,
W87-02983 2G

AHLF, W.
Direct Determination of Cd, Cu and Ni in the Elbe River Estuary with Zeeman AAS and Matrix Modification (Direktbestimmung von Cd, Cu and Ni im Elbeastuar mit Hilfe der Zeeman-Atomabsorptionsspektroskopie und Matrixmodifikation),
W87-03087 5A

AINA, P. O.
Root Distribution and Water Uptake Patterns of Maize Cultivars Field-Grown under Differential Irrigation,
W87-02817 2I

AIVAZYAN, O. M.
Stability Criterion of a Laminar Flow,
W87-02868 8B

AKHTAR, A.
Materials Technology for Turbine Performance,
W87-02687 8C

AKIN, E. W.
Waterborne Viral Gastroenteritis,
W87-02612 5C

AKKARI, K. H.
Herbicides and Seeding Rate Effects on Sprinkler-Irrigated Rice,
W87-03013 2I

AL-ANSARI, N. A.
Variation in Solute Concentration Within the River Almond and Its Effect on the Estimated Dissolved Load,
W87-03274 5B

AL-JABBARI, M. H.
Variation in Solute Concentration Within the River Almond and Its Effect on the Estimated Dissolved Load,
W87-03274 5B

ALBIGNAT, J. P.
Effects of Hydraulic Projects and Their Management on Water Quality,
W87-03297 6G

ALBRECHT, T. J.
Thoughts and Considerations for Hydraulic Design,
W87-03241 8B

ALEKSANDROVSKII, A. Y.
Comparison of Various Methods of Controlling the Long-Term Operating Regimes of Hydroelectric Stations,
W87-03176 8C

ALESSI, R. S.
Soil-Water Determination Using Fiber Optics,
W87-02723 2G

ALLEN, D. W.
Phosphorus Uptake by Klebsiella pneumoniae and Acinetobacter calcoaceticus,
W87-02741 5D

ALLEN, M. B.
Finite-Element Collocation Method for Variably Saturated Flow in Two Space Dimensions,
W87-03192 2F

ALLEN, R. L.
Decision Support System for Local Water Management,
W87-03064 6D

ALLOJU, C.
Modeling of Selective Withdrawal Intake Structures,
W87-03230 5G

AMANO, K.
Modeling for Estimating Representative Water Conditions in a River Basin,
W87-02604 5B

ANDERBERG, K.
Long Distqance Water Rights,
W87-02637 6E

ANDERSON, J. W.
Stream Improvements and Fish Response: A Bio-engineering Assessment,
W87-02932 4A

ANDERSON, L. G.
Benthic Fluxes of Cadmium, Copper, Nickel, Zinc and Lead in the Coastal Environment,
W87-03144 5B

Effect of Oxygen on Release and Uptake of Cobalt, Manganese, Iron and Phosphate at the Sediment-Water Interface,
W87-03143 5B

ANDREAE, M. O.
Determination of Acrylic Acid in Aqueous Samples by Electron Capture Gas Chromatography after Extraction with Tri-n-octylphosphine Oxide and Derivatization with Pentafluorobenzyl Bromide,
W87-02818 5A

Geochemistry of Tin in Rivers and Estuaries,
W87-03140 5B

ANDREOPOULOS, J.
Experiments on Vertical Plane Buoyant Jets in Shallow Water,
W87-02762 8B

ANDREWS, E. D.
Denudation of the Piceance Creek Basin, Colorado,
W87-03289 2J

ANESTIS, I.
Avoidance-Preference Reactions of Rainbow Trout (Salmo Gairdneri) After Prolonged Exposure to Chromium(VI),
W87-02698 5C

ANISIMOV, K. I.
Restoration of Pipe Drainage in Foundations of Hydraulic Structures on Carbonate Rocks,
W87-03184 8A

ANNANDALE, G. W.
Forecasting Sediment Distribution in Reservoirs During Unstable Conditions,
W87-02680 2J

APP, A. A.
Effect of Cultivated and Wild Rice Varieties on the Nitrogen Balance of Flooded Soil,
W87-02813 2I

ARAD, A.
Saline- versus Freshwater Contribution to the Thermal Waters of the Northern Jordan Rift Valley, Israel,
W87-02852 2F

ARAIN, R.
Nature of Particulate Organic Matter in the River Indus, Pakistan,
W87-03148 5A

ARGAMAN, Y.
Single-sludge Nitrogen Removal: Modeling and Experimental Results,
W87-02823 5D

ARGENSON, A.
Small Hydroelectric Power Plants for Very Low Heads, (Les Usines de Tres Basse Chute en Mini-Hydroelectricite),
W87-02571 8C

ARMADA GESSA, J. A.
Application of Environmental Management Principles in the Program for Eradication of Aedes (Stegomyia) aegypti (Linneus, 1762) in the Republic of Cuba, 1984,
W87-02824 5G

ARMON, R.
Concentration of Viruses from Water Using Pig Erythrocyte Ghost Cells,
W87-02650 5A

ARNELL, N. W.
Unbiased Plotting Positions for the General Extreme Value Distribution,
W87-03071 2E

ARSHENEVSKII, N. N.
Overspeeding Processes in Reversible Units of Pumped-Storage Stations,
W87-03179 8C

ARVIN, E.
Exchange of Organics, Phosphate and Cations between Sludge and Water in Biological Phosphorus and Nitrogen Removal Processes,
W87-02745 5D

ASARE-BOAMAH, N. K.
Triadimefon Protects Bean Plants from Water Stress through its Effects on Abscisic Acid,
W87-03202 2I

ASHTON, M.
Reverse Osmosis Can Be Cost Effective,
W87-03079 3A

ASRAR, G.
Remote Sensing Techniques for Assessing Water Deficits and Modeling Crop Response,
W87-02953 7B

ATCHISON, G. J.
Environmental Effects of Dikes and Revetments on Large Riverine Systems,
W87-03321 6G

ATUMA, S. S.
Insecticides and Metals in Nigerian Surface Water - Warri River,
W87-03028 5B

AUGUSTIN, B. J.
Soils Influence Irrigation,
W87-03020 2G

AURADA, K. D.
Physiogenic and Anthropogenic Controls of Global and Regional Ionic Runoff,
W87-03275 2E

AUSTIN, F. J.
Enterovirus Removal from Sewage: The Effectiveness of Four Different Treatment Plants,
W87-02706 5D

AYLSWORTH, J. D.
Dealing with the Drought,
W87-02565 3F

AYOUB, G. M.
Seawater Induced Algal Flocculation,
W87-02703 5D

AYRES, P. G.
Water or Salt Stress Increases Infectivity of Erysiphe pisi Conidia Taken from Stressed Plants,
W87-03175 5C

AZUMA, D. L.
Estimating Snow Load in California for Three Recurrence Intervals,
W87-03336 2C

BAASIRI, M.
Soil Application of a Hydrophilic Conditioner in Relation to Moisture, Irrigation Frequency and Crop Growth,
W87-02881 3F

BABA, M.
Computation of Wave Transmission Over a Shore Protecting Submerged Breakwater,
W87-03217 8B

Spectral and Statistical Characteristics of Shallow Water Waves,
W87-03218 8B

BABAJIMOPOULOS, C.
Mathematical Prediction of Thermal Stratification of Lake Ostrovo (Vegoritis), Greece,
W87-03198 2H

BABALOLA, O.
Effects of Tillage Methods and Water Regimes on Soil Properties and Yield of Lowland Rice from a Sandy Loam Soil in Southwest Nigeria,
W87-03164 2I

BABCOCK, W. H.
Tenmile Creek: A study of Stream Relocation,
W87-02935 4A

BACHMAT, Y.
Location of an Interface Observation Well: A Bayesian Approach,
W87-03187 2F

BADSHA, K. S.
Seasonal Abundance, Growth, Feeding and Age Composition of Flounder (Platichthys flesus (L.)) Populations of the Severn Estuary and Bristol Channel,
W87-03027 2L

BAEHR, A.
Immiscible Contaminant Transport in Soils and Groundwater with an Emphasis on Petroleum Hydrocarbons: System of Differential Equations vs Single Cell Model,
W87-02729 5B

BAILEY, D. A.
Growth and Nutritional Status of Petunia and Tomato Seedlings with Acidified Irrigation Water,
W87-03105 5C

BAKER, J. L.
Alternatives to the Use of Agricultural Drainage Wells,
W87-02624 4B

BAKER, J. M.
Resistance of Plant Roots to Water Loss,
W87-03005 2I

BALDWIN, K. C.
Development of a Collision Tolerant Pile Structure Concept,
W87-03219 8A

BALLAND, P.
Different Techniques for the Computation of River Nutrient Loads (Methodologies de Quantification des Flux de Nutriments en Riviere),
W87-03298 2H

BALTZ, D. M.
Patterns in Distribution and Abundance of a Noncoevolved Assemblage of Estuarine Fishes in California,
W87-02758 2L

BANAS, W. P.
Absence of Acclimation to Parathion by Rainbow Trout During Sublethal Exposure,
W87-02697 5C

BANERJEE, D. K.
Association Between Some Planktonic Species and Physicochemical Characteristics of the Water of Loktak Lake, Manipur, India,
W87-03025 2H

BANG, S.
Nitrate Load/Discharge Relationships and Nitrate Load Trends in Danish Rivers,
W87-03302 5B

BANNINK, M. H.
Procedure to Identify Different Groups of Hydraulic-Conductivity and Moisture-Retention Curves for Soil Horizons,
W87-03075 2G

BARBIER, Y.
Energy Recovery Small Hydro Plants on the Rhone River. The First Months of Operation of Champagneux Power Plant and the Sault-Brenaz Project, (Les Petites Centrales de Recuperation sur le Rhone. Les Premiers Mois d' Exploitation de la Centrale de Champagneux et le Project de Sault-Brenaz),
W87-02575 8C

BARR, D. I. H.
Direct Solutions for Normal Depth Using the Manning Equation,
W87-02963 2E

BARRETT, A. D.
Water Supply in Developing Countries: Improving on Current Practice,
W87-02784 5G

BARRON, W.
Water and Hygiene: The Case of North Carolina Farmworkers,
W87-02756 6D

BARTH, E. F.
Biological Phosphorus Removal: A Technology Evaluation,
W87-02820 5D

BARTHA, R.
Control of the Methylation Process in a Mercury-polluted Aquatic Sediment,
W87-02584 5B

BARTLETT, K. B.
Atmospheric Methane Sources: Alaskan Tundra Bogs, an Alpine Fen, and a Subarctic Boreal Marsh,
W87-02719 5B

BASSEREAU, M.
Standardized Design and Units for Small Hydroprojects 10 to 20 m Head, (Projets et Materiels Standards pour Petits Amenagements Hydrauliques de 10 a 20 m de Chute),
W87-02576 8C

BATEMAN, B. W.
Recovery of Viruses from Drinking-Water by Means of an In-Line Electropositive Cartridge Filter,
W87-02649 5A

BATTARBEE, R. W.
Lake Acidification and the Land-Use Hypothesis: A Mid-Post-Glacial Analogue,
W87-02810 2K

BAUER, A.
Estimation of Spring Wheat Spike Water Concentration and Grain Maturity from Air Temperature,
W87-02998 2I

BAUER, B. E.
Innovative Lagoon Liner Pays Off,
W87-03078 5D

BEAN, D. L.
Latex Admixtures for Portland Cement Concrete and Mortar,
W87-03318 8G

BEARD, J. B.
Controlling Turfgrass Water Use Rates,
W87-03017 2I

Turfgrass Water Use Rates,
W87-03014 2I

BEARMAN, J. E.
Trickle Irrigation of Wheat Applying Renovated Wastewater,
W87-02938 3F

BEATON, J. D.
Snow and Fertilizer Management for Continuous Zero-Till Spring Wheat,
W87-02879 3F

BEATTY, C.
Containing Landfill Leaks,
W87-02639 5B

BEIN, A.
Saline- versus Freshwater Contribution to the Thermal Waters of the Northern Jordan Rift Valley, Israel,
W87-02852 2F

BELANGER, S. E.
Seasonal, Behavioral and Growth Changes of Juvenile Corbicula Fluminea Exposed to Chrysotile Asbestos,
W87-02699 5C

BELFORT, G.
Concentration of Seeded and Naturally Occurring Enteroviruses from Waters of Varying Quality by Hollow Fiber Ultrafiltration,
W87-02648 5A

BELKAYA, H.
Computerized Layout Generation for Sanitary Sewers,
W87-03062 8A

BELL, P. R. F.
Ion Exchange Properties of Retorted Rundle Oil Shale,
W87-02707 5B

BELLAMY, W. D.
Slow Sand Filtration: Influences of Selected Process Variables,
W87-02611 5F

BELLEVILLE, G. G.
Physiological Innocuity of Asbestos in Water,
W87-02831 5C

BELORGEY, M.
Analysis of the Velocity Field in a Boundary Layer Generated by a Water Wave, (Analyse du Champ des Vitesses dans la Couche Limite Generee par une Onde Progressive (Houle)),
W87-02790 8B

BEN-ASHER, J.
Infiltration and Water Extraction from Trickle Irrigation Source: The Effective Hemisphere Model,
W87-02725 2G

BEN-ZVI, M.
Location of an Interface Observation Well: A Bayesian Approach,
W87-03187 2F

BENEDICT, A. H.
Biological Phosphorus Removal: A Technology Evaluation,
W87-02820 5D

BENNETT, J. M.
Interactive Effects of Nitrogen and Water Stresses on Water Relations of Field-Grown Corn Leaves,
W87-02994 2I

BENNETT, J. P.
Nutrient and Sediment Budgets for the Tidal Potomac River and Estuary,
W87-03290 5B

BENNIE, A. T. P.
Effect of Deep Tillage and Controlled Traffic on Root Growth, Water-Use Efficiency and Yield of Irrigated Maize and Wheat,
W87-03165 3F

BENOIT, R. E.
Biodegradation of Methanol and Tertiary Butyl Alcohol in Subsurface Systems,
W87-02732 5B

BENTLEY, H. W.
137C-135C Variations in a Diffusion-Controlled Groundwater System,
W87-03149 5A

BENVILLE, P. E.
Primary and Secondary Stress Responses of Striped Bass (Morone saxatilis) Exposed to Benzene,
W87-02771 5C

BERAN, M.
Unbiased Plotting Positions for the General Extreme Value Distribution,
W87-03071 2E

BERESFORD, J. D.
Evaporation from the Understorey in the Jarrah (Eucalyptus Marginata Don Ex Sm.) Forest, Southwestern Australia,
W87-02679 2D

BERG, S.
Finding Uses for Sludge,
W87-02641 5E

BERMAN, M.
Control of the Methylation Process in a Mercury-polluted Aquatic Sediment,
W87-02584 5B

BERNARD, J. M.
Distribution and Standing Crop of Living and Dead Roots in Three Wetland Carex Species,
W87-03204 2H

BERNDT, H.
Multielement Trace Preconcentration from Water on Activated Carbon for the Sample Pretreatment for Atomic Spectroscopy (Flame-AAS, ICP/OES), (Multielement-Spurenanreicherung aus Wassern an Aktivkohle zur Probenvorbereitung fur die Atomspektroskopie (Flammen-AAS, ICP/OES)),
W87-02799 5A

BERTNESS, M. D.
Survivorship and Spatial Development of Spartina alterniflora Loisel. (Gramineae) Seedlings in a New England Salt Marsh,
W87-03096 2L

BESCHTA, R. L.
Morphological Features of Small Streams: Significance and Function,
W87-02931 4A

BEST, A. G.
Biological Phosphorus and Nitrogen Removal at an Experimental Full Scale Plant in the U.K.,
W87-02750 5D

BEVEN, K.
Distribution Function Approach to Water Flow in Soil Macropores Based on Kinematic Wave Theory,
W87-02858 2G

BEWTRA, J. K.
Design Factors for the Scouring of Deposited Materials in Water and Wastewater Treatment Systems,
W87-02674 5F

BEYER, R.
Borehole Television for Geotechnical Investigations,
W87-03032 7B

BHATIA, B.
Association Between Some Planktonic Species and Physicochemical Characteristics of the Water of Loktak Lake, Manipur, India,
W87-03025 2H

BHELLA, H. S.
Muskmelon Growth, Yield, and Nutrition as Influenced by Planting Method and Trickle Irrigation,
W87-03108 3F

BHOLE, A. G.
Innovative Technique for Determining Velocity Gradient in Coagulation--Flocculation Process,
W87-02708 5F

BIANCHI, A.
Metabolical Activity of Bacteria in Geothermal Spring-waters Dating from Dogger and Trias Periods in the Bassin Parisien, (Activites Metaboliques des Bacteries des Eaux Geothermales du Dogger et du Trias du Bassin Parisien),
W87-02562 5B

BICKNELL, E. A.
Concentration of Seeded and Naturally Occurring Enteroviruses from Waters of Varying Quality by Hollow Fiber Ultrafiltration,
W87-02648 5A

BIDINGER, F. R.
Water Deficit During Panicle Development in Pearl Millet: Yield Compensation by Tillers,
W87-03157 2I

BINK, N. J.
Evaporation Data from a Capillary Evaporimeter,
W87-03073 7B

BIRDEN, H. H.
Lead Dissolution From Soldered Joints,
W87-02607 5B

BISHOP, R. C.
Travel Cost Model for Lake Recreation: A Comparison of Two Methods for Incorporating Site Quality and Substitution Effects,
W87-02872 6D

BISWAS, A. B.
Mathematical Modelling for Multi-Aquifer Groundwater Basins,
W87-02848 2F

BITTMAN, S.
Inexpensive System Using Drip-Emitters for Irrigating Small Plots,
W87-02876 3F

BITTON, G.
Bacteria and Viruses in Aerobically Digested Sludge: Influence of Physical and Chemical Treatments on Survival and Association with Flocs under Laboratory Conditions,
W87-02660 5D

BLACK, A. L.
Estimation of Spring Wheat Spike Water Concentration and Grain Maturity from Air Temperature,
W87-02998 2I

BLACK, M. C.
Anomalous Binding of Organic Contaminants May Be Artifactual Due to Radiochemical Impurities,
W87-02700 5A

BLAD, B. L.
Use of Portable Rainout Shelters to Induce Water Stress,
W87-02991 2I

Water Use Efficiency in Soybean Pubescence Density Isolines-A Calculation Procedure for Estimating Daily Values,
W87-03000 2I

BLANC, J.
Problems Encountered in The Operation of Small Power Plants, (Problemes Rencontres a la Mise en Service de Microcentrales),
W87-02572 8C

BLANTON, W. E.
Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-02751 5D

BLOCK, J. C.
Polyphosphate Kinase Activity during Phosphate Uptake by Bacteria,
W87-02736 5D

BOARDMAN, G. D.
Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-02751 5D

BODDE, D. L.
Emerging Trends in Infrastructure Financing,
W87-02606 6C

BOEHM, P. D.
Organic and Trace Metal Levels in Ocean Quahog, Arctica islandica Linne, from the Northwestern Atlantic,
W87-02759 5B

BOHLEN, W. F.
Evaluation of the Factors Governing the Mobility of Dredged Material Placed at Open Water Disposal Sites,
W87-03252 5E

BOL'SHEV, S. A.
Experience in Creating Mechanical Equipment for Northern Hydroelectric Stations,
W87-03178 8C

BOLE, J. B.
Effect of Irrigation and Nitrogen Fertilizer on the Yield and Protein Content of Soft White Spring Wheat,
W87-02877 3F

BOLT, G. H.
Transport of Solutes in Soil: Basic Features of Front Retardation,
W87-02733 5B

BOLTER, M.
Structuring of Ecological Data Sets by Methods of Correlation and Cluster Analysis,
W87-02597 2L

BONACCI, O.
Hydrological Investigations of Dinaric Karst at the Krcic Catchment and the River Krka Springs (Yugoslavia),
W87-02845 2A

BONGRAND, TH.
Taking Hydrology and Economic Factors into Account for Calculating the Economic Diameter of the Penstocks for High Head Micropower Plants, (Prise en Compte de l'Hydrologie et des Facteurs Economiques dans le Calcul du Diametre Economique des Conduites Forcees des Microcentrales Haute Chute),
W87-02568 8C

BOOLOOTIAN, M. R.
Controlling Suspended Sediment Samplers by Programmable Calculator and Interface Circuitry,
W87-03337 7B

BORMANN, F. H.
Transport and Loss of Nitrous Oxide in Soil Water After Forest Clear-cutting,
W87-02912 5B

BOSCHET, A. F.
Problem of Phosphorus in France - Its Presence in Natural Waters and Biological Phosphorus Removal,
W87-02734 5G

BOSS, T. R.
Environmental Gradients in Northwest Freshwater Wetlands,
W87-02615 2H

BOTHA, F. J. P.
Effect of Deep Tillage and Controlled Traffic on Root Growth, Water-Use Efficiency and Yield of Irrigated Maize and Wheat,
W87-03165 3F

BOUMA, J.
Procedure to Identify Different Groups of Hydraulic-Conductivity and Moisture-Retention Curves for Soil Horizons,
W87-03075 2G

BOURBIGOT, M. M.
Study of Indigenous Virus Removal at Different Stages in a Drinking Water Plant Treating River Water,
W87-02665 5F

BOURODIMOS, E. L.
Unsaturated Flow Through Solid Waste Landfills: Model and Sensitivity Analysis,
W87-02628 5B

BOUWES, N. W.
Travel Cost Model for Lake Recreation: A Comparison of Two Methods for Incorporating Site Quality and Substitution Effects,
W87-02872 6D

BOWDEN, W. B.
Transport and Loss of Nitrous Oxide in Soil Water After Forest Clear-cutting,
W87-02912 5B

BOWMAN, R. S.
Percolation of Water Below an Irrigated Field,
W87-02722 5B

Transport of Conservative Tracers in the Field Under Intermittent Flood Irrigation,
W87-03191 2G

BRADDOCK, R. D.
Comparison of Steady Infiltration Solutions for Spherical Cavities Under Simple Versus Variable Hydraulic Properties,
W87-02712 2G

BRADLEY, C. E.
Plains Cottonwood Recruitment and Survival on a Prairie Meandering River Floodplain, Milk River, Southern Alberta and Northern Montana,
W87-02769 2I

BRADLEY, R. M.
Water Use in Urban Korea,
W87-02617 6D

BRADLEY, S. B.
Influence of Catastrophic Floods on Water Quality as Recorded in the Sediments of Blagdon Lake, England,
W87-03306 2H

BRADLEY, S. G.
Measurements of pH versus Drop Size in Natural Rain,
W87-02811 2B

BRADY, D. K.
Assessment of Odorous Emissions from Sewage Pumpstations,
W87-03029 5D

BRANNON, J. M.
Effectiveness of Capping in Isolating Dutch Kills Sediment from Biota and the Overlying Water,
W87-03332 5G

BRANSON, R. L.
Water Conservation and Recycling in Ornamentals Production,
W87-02957 3F

BRAUN, Y.
Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: I. Salinity During Growth Modulates the Proton Pump in the Halophyte Atriplex Nummularia,
W87-02717 2I

Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: II. K(+) Strongly Promotes Development of Membrane Potential in Vesicles from Cotton Roots,
W87-02718 2I

BRAVO, M.
Effect of Cultivated and Wild Rice Varieties on the Nitrogen Balance of Flooded Soil,
W87-02813 2I

BREINER, E. M.
Low Level Radioactive Waste Disposal--Technology and Public Policy,
W87-02775 5E

BRENNER, A.
Single-sludge Nitrogen Removal: Modeling and Experimental Results,
W87-02823 5D

BRICKER, O. P.
Weathering Reactions, Water Chemistry and Denudation Rates in Drainage Basins of Different Bedrock Types: I - Sandstone and Shale,
W87-03288 2K

BRINKMANN, W. L. F.
Dissolved and Suspended Loads of the Regulated River Nidda in the Rhine-Main Area,
W87-03299 5B

BRISCOE, J.
Water and Hygiene: The Case of North Carolina Farmworkers,
W87-02756 6D

BRITZ, T. J.
Effect of Effluent Recirculation on the Performance of a Two Stage Anaerobic Process,
W87-03088 5D

BROADAWAY, S. C.
Bacteria Associated with Granular Activated Carbon Particles in Drinking Water,
W87-02891 5B

BRODISCH, K. E. U.
Interaction of Different Groups of Micro-Organisms in Biological Phosphate Removal,
W87-02739 5D

BROOKS, J. M.
Determination of Acrylic Acid in Aqueous Samples by Electron Capture Gas Chromatography after Extraction with Tri-n-octylphosphine Oxide and Derivatization with Pentafluorobenzyl Bromide,
W87-02818 5A

BROOKSHIRE, D. S.
Existence Values and Normative Economics: Implications for Valuing Water Resources,
W87-03188 6B

BROWN, D. M.
Corn Yield Response to Irrigation, Plant Population and Nitrogen in a Cool, Humid Climate,
W87-02878 3F

BROWN, J. M. B.
Non-Darcian Transmission of Water in Certain Humified Peats,
W87-02846 2G

BROWN, K. W.
Hazardout Waste Disposal: What Are the Options,
W87-03015 5E

Under EPA Scrutiny: Underground Storage Tanks,
W87-03021 5B

BROWN, T. G.
Instruments and Expertise Add Up to Good Pipe Locating,
W87-02928 8C

BROWNLEE, D. E.
Placers of Cosmic Dust in the Blue Ice Lakes of Greenland,
W87-02913 2C

BRUIJNZEEL, L. A.
Chemical Mass Balance of a Small Basin in a Wet Monsoonal Environment and the Effect of Fast-Growing Plantation Forest,
W87-03291 2H

BRUN, C. A.
Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. I. Soil Moisture, Water Relations, Tree and Fruit Growth,
W87-03110 3F

Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. II. Mineral Composition of Fruit and Leaves, Fruit Disorders, and Fruit Set,
W87-03111 3F

BRUNO, R. A.
Organic and Trace Metal Levels in Ocean Quahog, Arctica islandica Linne, from the Northwestern Atlantic,
W87-02759 5B

BRYAN, G. W.
Decline of the Gastropod Nucella lapillus Around South-West England: Evidence for the Effect of Tributyltin from Antifouling Paints,
W87-03053 5C

BUCHAN, L.
Aut-Ecological Study of Acinetobacter in Activated Sludge,
W87-02744 5D

BUDREWICZ, E.
Salt Tolerance in the Triticeae: Salinity-Induced Changes in the Leaf Solute Composition of Some Perennial Triticeae,
W87-02785 2I

BUELOW, D.
Selective Withdrawal Structure Operation Experiences in ORD,
W87-03243 8A

BURCH, G. J.
Preferential Flow and Hydraulic Conductivity of Forest Soils,
W87-02724 2G

BURRIS, D. R.
Thermodynamic Study of Solutions of Liquid Hydrocarbon Mixtures in Water,
W87-03145 1B

BURSTEIN, D.
Adapting Industrial Approaches to Municipal Wastewater Treatment Problems,
W87-02905 5D

BURT, G. R.
Decline of the Gastropod Nucella lapillus Around South-West England: Evidence for the Effect of Tributyltin from Antifouling Paints,
W87-03053 5C

BURTON, J. S.
History of the Federal-State Cooperative Water Resources Research Institute Program,
W87-02632 9D

BUSCH, C. D.
Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-03010 2I

BUTLER, M.
Electrofocusing of Viruses and Sensitivity to Disinfection,
W87-02664 5D

BYRD, J. T.
Geochemistry of Tin in Rivers and Estuaries,
W87-03140 5B

CAIRNS, J.
Seasonal, Behavioral and Growth Changes of Juvenile Corbicula Fluminea Exposed to Chrysotile Asbestos,
W87-02699 5C

CALABRESE, E. J.
Lead Dissolution From Soldered Joints,
W87-02607 5B

CALAMANO, W
Direct Determination of Cd, Cu and Ni in the Elbe River Estuary with Zeeman AAS and Matrix Modification (Direktbestimmung von Cd, Cu and Ni im Elbeastuar mit Hilfe der Zeeman-Atomabsorptionsspektroskopie und Matrixmodifikation),
W87-03087 5A

CALENDRAY, J. F.
Analysis of Transient Phenomena in Hydroelectric Generation Plants, (Calcul des Transitoires dans les Installations Hydrauliques de Production d'Energie),
W87-02580 8C

CAMMANN, K.
Flow Injection Analysis of Chloride in Tap and Sewage Water Using Ion-Selective Electrode Detection,
W87-02798 5A

CAMPBELL, C. A.
Snow and Fertilizer Management for Continuous Zero-Till Spring Wheat,
W87-02879 3F

CAMPBELL, S. G.
Primary Productivity (C14) at Twin Lakes Colorado: 1973-81 Study Results,
W87-03326 2H

CAMPER, A. K.
Bacteria Associated with Granular Activated Carbon Particles in Drinking Water,
W87-02891 5B

CANTERFORD, J.H.
Hydrometallurgy: Winning Metals with Water,
W87-02618 5G

CAPRIO, J. M.
Effect of Standing Small Grain Stubble on Snow Cover Characteristics in Alternate Fallow Strip Cropping,
W87-02990 2C

CARLTON-SMITH, C. H.
Manurial Value of Septic-Tank Sludge on Grassland,
W87-03102 5E

CARPENTER, R.
Arsenic Distributions in Porewaters and Sediments of Puget Sound, Lake Washington, the Washington Coast and Saanich Inlet, B.C.,
W87-03133 5B

CARRON, A.
Water-hammer Diagnostic Established by A Numerical Method, (Un Diagnostic de Coup de Belier Etabli par Modele Numerique),
W87-02577 8C

CARROW, R. N.
Managing Water for Turfgrass,
W87-03016 2I

Soil Compaction and Moisture Stress Preconditioning in Kentucky Bluegrass. I. Soil Aeration, Water Use, and Root Responses,
W87-02982 2G

Soil Compaction and Moisture Stress Preconditioning in Kentucky Bluegrass. II. Stomatal Resistance, Leaf Water Potential, and Canopy Temperature,
W87-02983 2G

CARTER, A. D.
Biogeochemical Controls on River Water Quality in a Forested Drainage Basin, Warwickshire, UK,
W87-03292 2E

CARTER, N. S.
Interactive Effects of Sewage Effluent Irrigation and Supplemental Fertilization on Container-Grown Trees,
W87-02958 3C

CARTTER, M.
Phenotypic Characteristics of Coliform and Noncoliform Bacteria from a Public Water Supply Compared with Regional and National Clinical Species,
W87-02894 5A

CASSEL, D. K.
Corn Irrigation Scheduling in Humid Regions on Sandy Soils with Tillage Pans,
W87-02981 3F

Response of Corn to Tillage and Delayed Irrigation,
W87-03007 2I

CASSIDY, R. A.
Reservoir Regulation and Selective Withdrawal in Oregon,
W87-03226 6D

CATALAN, J. P.
Few Data about Independent Producers of Hydroelectricity in France, (Quelques Donnees sur la Production Hydroelectrique Autonome en France),
W87-02567 8C

CATALANO-SHERMAN, J.
Humic Acid Interference with Virus Recovery by Electropositive Microporous Filters,
W87-02900 5A

CAULKINS, P. P.
Travel Cost Model for Lake Recreation: A Comparison of Two Methods for Incorporating Site Quality and Substitution Effects,
W87-02872 6D

CAUSEY, E. M.
Historic Trends in the Sediment Flow Regime of the Mississippi River,
W87-03195 2J

CAUSSADE, B.
Numerical Simulation Relating Land Uses Within a Drainage Basin to the Downstream River Water Quality (Simulation Numerique de l'Influence des Pratiques Culturales dans un BAsin Versant sur la Qualite des Eaux a Son Exutoire),
W87-03300 6G

CEULEMANS, R.
Effect of Short-term Water Stress on Leaf Gas Exchange Processes and Plant Water Potential in Schefflera,
W87-03104 2I

CHABASSE, D.
Sanitary Study of Surface Water and of the Beach of a Water Sports and Leisure Complex,
W87-02777 5B

CHALFEN, M.
Analytical and Numerical Solution of Saint-Venant Equations,
W87-03067 2E

CHANGNON, S. A.
Use of Climate Predictions to Decide a Water Management Problem,
W87-02633 6A

CHAPMAN, J.
Rates of Mineral Element Leaching from Leaves of Nine Plant Species from a Southern Appalachian Forest Succession Subjected to Simulated Acid Rain,
W87-03206 5C

CHAPUT, D.
Retardation of Toxic Chemicals in a Contaminated Outwash Aquifer,
W87-02731 5B

CHARACH, C.
Infiltration and Water Extraction from Trickle Irrigation Source: The Effective Hemisphere Model,
W87-02725 2G

CHAREF, A.
Organic Water: Isotopic Characterization and Evidence for Its Role in the Fedj-el-Adoum Pb-Zn Deposit, Tunisia (Eau organique: caracterisation isotopique et evidence de son role dans le gisement Pb-Zn de Fedj-el-Adoum, Tunisie),
W87-03090 5B

CHASON, D. B.
Hydraulic Conductivity and Related Physical Properties of Peat, Lost River Peatland, Northern Minnesota,
W87-02715 2G

CHAUDHURI, U. N.
Procedure to Select Drought-Tolerant Sorghum and Millet Genotypes Using Canopy Temperature and Vapor Pressure Deficit,
W87-03001 2I

CHEE, S. P.
Erosion of Unconsolidated Gravel Beds,
W87-02673 2J

CHERIERE, B.
Creation of a Cross-Flow Turbines Range, (Creation d'une Gamme de Turbines a Flux Traversant),
W87-02569 8C

CHERNENKO, G. F.
Comparison of Various Methods of Controlling the Long-Term Operating Regimes of Hydroelectric Stations,
W87-03176 8C

CHERNEY, D. J. R.
Influence of Climatic Factors and Forage Age on the Chemical Components of Ryegrass Related to Grass Tetany,
W87-02980 2I

CHERRY, D. S.
Seasonal, Behavioral and Growth Changes of Juvenile Corbicula Fluminea Exposed to Chrysotile Asbestos,
W87-02699 5C

CHERRY, J. A.
137C-135C Variations in a Diffusion-Controlled Groundwater System,
W87-03149 5A

CHESTERIKOFF, A.
Overview of PCB Pollution and its Behavior in Seine River, (Apercu sur la Pollution par les P.C.B. (Polychlorobiphenyles) en Seine, et son Comportement),
W87-02564 5B

CHETELAT, R.
Contrasting Response to Salt Stress of Two Salinity Tolerant Creeping Bentgrass Clones,
W87-03156 5C

CHEVALIER, D.
Problem of Phosphorus in France - Its Presence in Natural Waters and Biological Phosphorus Removal,
W87-02734 5G

CHEVREUIL, M.
Overview of PCB Pollution and its Behavior in Seine River, (Apercu sur la Pollution par les P.C.B. (Polychlorobiphenyles) en Seine, et son Comportement),
W87-02564 5B

CHIKAMI, S.
Basin-wide Ecological Fate Model for Management of Chemicals Hazard,
W87-02975 5B

CHISWELL, B.
Speciation of Manganese in Freshwaters,
W87-03051 2K

CHOI, K. W.
Slack Tide Oxygen Balance Model,
W87-02889 5B

CHRISTENSEN, T.
Validation of a Prognosis Based Upon a Eutrophication Model,
W87-02602 5C

CHRISTOFFERSEN, J. B.
Bed Friction and Dissipation in a Combined Current and Wave Motion,
W87-03210 8B

CHUDOBA, J.
Microbial Polymers in the Aquatic Environment-I: Production by Activated Sludge Microorganisms under Different Conditions,
W87-02694 5D

Microbial Polymers in the Aquatic Environment-II: Isolation from Biologically Non-purified and Purified Municipal Waste Water and Analysis,
W87-02695 5D

Microbial Polymers in the Aquatic Environment-III: Isolation from River, Potable and Underground Water and Analysis,
W87-02696 5B

CLARK, R. P.
Kleingrass Yield and Quality Under Three Irrigation Regimes When Harvested at Anthesis,
W87-02993 3F

CLAVEL, R. L.
Dual-use Filters Keep Wet-weather Flows Under Control,
W87-02926 5D

CLAWSON, K. L.
Use of Portable Rainout Shelters to Induce Water Stress,
W87-02991 2I

Water Use Efficiency in Soybean Pubescence Density Isolines-A Calculation Procedure for Estimating Daily Values,
W87-03000 2I

CLEARY, E. C.
Effect of Standing Small Grain Stubble on Snow Cover Characteristics in Alternate Fallow Strip Cropping,
W87-02990 2C

CLOETE, T. E.
Aut-Ecological Study of Acinetobacter in Activated Sludge,
W87-02744 5D

COBB, G. S.
Irrigation Scheduling Effects on Container Media and Canopy Temperatures and Growth of 'Hershey's Red' Azalea,
W87-03103 3F

COBB, P. R.
Characterization and Classification of Seaside-Salt-marsh Soils on Virginia's Eastern Shore,
W87-02919 2L

COCCIA, M.
New Strategies for the Isolation of Microorganisms Responsible for Phosphate Accumulation,
W87-02740 5D

COE, J. Q.
Models for Water and Power Scheduling for the California State Water Project,
W87-02626 6A

COHAN, J. L.
Complexity in Columbia River Systems Modeling,
W87-03059 6B

COKER, E. G.
Manurial Value of Septic-Tank Sludge on Grassland,
W87-03102 5E

COLLINS, D. N.
Solute Yield From a Glacierized High Mountain Basin,
W87-03276 5B

COLOMBANI, J.
Dissolved Material Concentration in Surface Waters of Africa. Two Contrasting Examples in the Rivers of Togo and the Medjerdah in Tunisia (Evolution de la Concentration en Matieres Dissoutes en Afrique. Deux Exemples Opposes: les Fleuves du Togo et la Medjerdah en Tunisie),
W87-03277 5B

COLWELL, R. R.
Viable but Nonculturable Stage of Campylobacter jejuni and Its Role in Survival in the Natural Aquatic Environment,
W87-02899 5B

CONNOR, J. N.
Efficient Method of Applying Aluminum Salts for Sediment Phosphorus Inactivation in Lakes,
W87-02635 5G

COOK, A. M.
Orthanilic Acid and Analogues as Carbon Sources for Bacteria: Growth Physiology and Enzymic Desulphonation,
W87-02781 5D

COONEY, J. J.
Effect of Organotins on Fecal Pollution Indicator Organisms,
W87-02901 5C

COOPER, A. B.
Developing Management Guidelines for River Nitrogenous Oxygen Demand,
W87-02822 5G

COPELAND, R. R.
Mill Creek Channel, Walla Walla, Washington: Hydraulic Model Investigation,
W87-03335 8B

CORAPCIOGLU, M. Y.
Immiscible Contaminant Transport in Soils and Groundwater with an Emphasis on Petroleum Hydrocarbons: System of Differential Equations vs Single Cell Model,
W87-02729 5B

CORNELSEN, A.
Effect of Woven Plastic Mulch, Herbicides, Grass Sod, and Nitrogen on 'Foch' Grapes Under Irrigation,
W87-03106 3F

CORTES, P. M.
Gas Exchange of Field-Grown Soybean Under Drought,
W87-02999 2I

COSBY, B. J.
Preliminary Model of Long-Term Changes in Stream Acidity in Southwestern Scotland,
W87-02682 5G

COSBY, J.
Modelling the Effects of Acidic Deposition And Conifer Afforestation on Stream Acidity in the British Uplands,
W87-03068 5C

COSSETTE, M.
Physiological Innocuity of Asbestos in Water,
W87-02831 5C

COTE, P. C.
Estimation of Wastewater Treatment Costs: Evaluation of the CAPDET Model for Canadian Conditions,
W87-02670 5D

COTHERN, C. R.
Drinking-Water Contribution to Natural Background Radiation,
W87-03084 5F

COTTER, P. F.
Effects of Pattern and Amount of Simulated Rainfall on Seedling Dynamics of Weeping Lovegrass and Kleingrass,
W87-03011 2I

COUBROUGH, P.
Practical Direct Plaque Assay for Coliphages in 100-ml Samples of Drinking Water,
W87-02890 5A

COUILLARD, D.
Functional Design of Activated Sludge Processes with Heavy Metal Inhibition,
W87-03131 5D

COVER, K. A.
Application of Computer Intensive Statistics to Parameter Uncertainty in Streamflow Synthesis,
W87-02945 2E

COX, J. J.
Influence of Catastrophic Floods on Water Quality as Recorded in the Sediments of Blagdon Lake, England,
W87-03306 2H

COX, W. J.
Growth and Yield of Sunflower and Soybean Under Soil Water Deficits,
W87-02992 2I

CRABTREE, R. W.
Ion-Exchange Resin Samplers for the In-Site Measurement of Major Cations in Soilwater Solute Flux,
W87-02678 7B

CRAMER, G. R.
Responses of Lettuce to Salinity. I. Effects of NaCl and Na2SO4 on Growth,
W87-03154 5C

Salt Responses of Lettuce to Salinity. II. Effect of Calcium on Growth and Mineral Status,
W87-03155 5C

CRANDALL, R. A.
Use of Ultraviolet Light in the Treatment of Water in Public Spas and Hot Tubs,
W87-02755 5F

CREWS, J. E.
Minimizing the Cost of Coping with Droughts: Springfield, Illinois,
W87-03057 6D

CRIAUD, A.
Study of Foamy Thermomineral Water of French Massif Central. I. Oxidation-reduction Potential and Behavior of Iron (Etude des eaux Thermominearales Carbogazeuses du Massif Central Francais. I. Potentiel d'Oxydo-Reduction et Comportement du Fer),
W87-03134 5B

Study of Foamy Thermomineral Water of French Massif Central. II. Behavior of Some Trace Metals, Arsenic, Antimony and Germanium, (Etude des Eaux Thermominerales Carbogazeuses du Massif Central Francais. II. Comportement de Quelques Metaux en Trace, de l'Arsenic, de l'Antimoine et du Germanium),
W87-03146 2K

CROXFORD, R.
New Analogue Computer for the Study of Pumping Tests under Falling Water-Table Conditions,
W87-02854 7B

CRUZ, I.
Spatial Variability and Soil Sampling for Salinity and Sodicity Appraisal in Surface Irrigated Orchards,
W87-02726 2G

CUDWORTH, A. G.
Evolution of PMP Cooperative Studies,
W87-03063 8A

CUENCA, A. I.
Detection of Hepatitis A Virus (HAV) in Drinking Water,
W87-02646 5A

CULLINEY, T. W.
Impact of Chemically Contaminated Sewage Sludge on the Collard Arthropod Community,
W87-03081 5C

CUTSHALL, N. H.
Geochemical and Environmental Processes Affecting Radionuclide Migration from a Formerly Used Seepage Trench,
W87-03135 5E

CZAPLICKI, J. S.
Research Design for Tucson Aqueduct, Phase B Data Recovery,
W87-03328 6G

Supplemental Class III Archaeological Survey of the Phase A, Reach 3 Corridor, Tucson Aqueduct, Central Arizona Project: Late Sedentary and Early Classic Period Tucson Basin Hohokam Occupation in the Lower Santa Cruz Basin, Marana to Rillito, Arizona,
W87-03329 6G

D'ADAMO, P. C.
Pump Station Gets Navy Discharge and New Life as Civilian,
W87-02925 5F

D'ITRI, F. M.
Trihalomethane Levels in Chlorinated Michigan Drinking Water,
W87-02605 5F

DAHL, B. E.
Effects of Pattern and Amount of Simulated Rainfall on Seedling Dynamics of Weeping Lovegrass and Kleingrass,
W87-03011 2I

DAHLBO, K.
Three-dimensional Water-Quality-Transport Model Compared with Field Observations,
W87-02970 2H

DAHLIN, W. Q.
Passive Screen Water Intake Design Studies,
W87-02767 8I

DANE, J. H.
Combined Effect of Hysteresis and Temperature on Soil-Water Movement,
W87-02857 2G

Temperature Dependence of Soil Water Retention Curves,
W87-02914 2G

DANIELS, R. A.
Patterns in Distribution and Abundance of a Noncoevolved Assemblage of Estuarine Fishes in California,
W87-02758 2L

DARDEAU, E. A.
Historic Trends in the Sediment Flow Regime of the Mississippi River,
W87-03195 2J

DAS, M. M.
Direct Solutions for Normal Depth Using the Manning Equation,
W87-02963 2E

DASGUPTA, S. P.
Mathematical Modelling for Multi-Aquifer Groundwater Basins,
W87-02848 2F

DATTA, P. S.
Trend Analysis of Water Quality in the Sabarmati River at Ahmedabad for a Decade (1969-1978),
W87-03278 5G

DAUMAS, S.
Metabolical Activity of Bacteria in Geothermal Spring-waters Dating from Dogger and Trias Periods in the Bassin Parisien, (Activites Metaboliques des Bacteries des Eaux Geothermales du Dogger et du Trias du Bassin Parisien),
W87-02562 5B

DAVIDOFF, B.
Goodness of Fit for Eight Water Infiltration Models,
W87-02923 2G

DAVIES, F. T. JR.
Nursery Irrigation-Syringe System That Monitors Environmental Parameters,
W87-03107 7C

DAVIES, R.
Response of Cloud Supersaturation to Radiative Forcing,
W87-03214 2B

DAVIS, J. S.
Dissolved Loads in Streams and Rivers - Discharged and Seasonally Related Variations,
W87-03279 5B

DAVIS, S.
Prediction of the Distribution Constant of some Solutes Containing Hydrophilic Functional Groups from Data on the Solubility of Water in Organic Solvents,
W87-02906 1B

DAY, E. W.
Liquid Chromatographic Determination of Fluridone Aquatic Herbicide and Its Metabolite in Fish and Crayfish,
W87-03113 5A

DAY, J. C.
Wildland Management on Point Pelee, Rondeau, and Long Point Peninsulas, Lake Erie,
W87-02591 6G

DE GRUIJTER, J. J.
Procedure to Identify Different Groups of Hydraulic-Conductivity and Moisture-Retention Curves for Soil Horizons,
W87-03075 2G

DE LA GUARDIA, M.
Flame Absorption Spectroscopic Determination of Cadmium, Copper, Iron, Lead, and Zinc in Mussels,
W87-03115 5A

DE MORA, S. J.
Measurements of pH versus Drop Size in Natural Rain,
W87-02811 2B

DE VRIES, J. J.
Analysis of Earth-Tide-Induced Groundwater Flow in Eastern Botswana,
W87-02840 2F

DEATON, M. L.
Procedure to Select Drought-Tolerant Sorghum and Millet Genotypes Using Canopy Temperature and Vapor Pressure Deficit,
W87-03001 2I

DEINEMA, M. H.
Some Physiological Characteristics of Acinetobacter spp. Accumulating Large Amounts of Phosphate,
W87-02742 5D

DELAUNE, R. D.
Radionuclide Concentrations in Louisiana Soils and Sediments,
W87-03085 5B

DELVAUX, P.
Physiological Innocuity of Asbestos in Water,
W87-02831 5C

DEM'YANOVA, E. A.
Construction of Dams on Soils Containing Soluble Salts,
W87-03186 8E

DEMALACH, J.
Trickle Irrigation of Wheat Applying Renovated Wastewater,
W87-02938 3F

DEMARCH, B. G. E.
Interlaboratory Comparison of Analyses for Heavy Metals in Clam Tissue,
W87-03114 5A

DEMETRACOPOULOS, A. C.
Modeling Leachate Production from Municipal Landfills,
W87-02883 5B

Unsaturated Flow Through Solid Waste Landfills: Model and Sensitivity Analysis,
W87-02628 5B

DENICHILO, N. M.
Overcoming Natural and Man-Made Obstacles to Solve Urban Flooding Problems,
W87-03118 4C

DERMOTT, R. M.
Metal Concentrations in the Annual Shell Layers of the Bivalve Elliptio complanata,
W87-02764 5B

DESAULNIERS, D. S.
137C-135C Variations in a Diffusion-Controlled Groundwater System,
W87-03149 5A

DINAR, A.
Production Function for Cotton with Dated Irrigation Quantities and Qualities,
W87-03189 3F

DINOVO, J. X.
State Common Law Water Rights in the Context of the Federal System,
W87-03312 6E

DISSANAYAKE, C. B.
Chemistry of Tap Water in Sri Lanka - Implications on Health,
W87-03026 5F

Environmental Chemistry of Rainwater in Sri Lanka,
W87-03023 2B

Groundwater Occurrences in the Hard Rock Terrains of Sri Lanka - A Case Study,
W87-03047 2F

DITORO, D. M.
Anomalous Binding of Organic Contaminants May Be Artifactual Due to Radiochemical Impurities,
W87-02700 5A

DOBBERKAU, H. J.
Interactions between Biotic and Abiotic Factors and Viruses in a Water System,
W87-02657 5B

DOLD, P. L.
Kinetics of Biological Phosphorus Release,
W87-02737 5D

DOLEZAL, M.
Microbial Polymers in the Aquatic Environment-III: Isolation from River, Potable and Underground Water and Analysis,
W87-02696 5B

DONKER, H. J. G. W.
Phosphorus Removal at Low Sludge Loadings,
W87-02747 5D

DONNER, R. G.
Managing an Unfiltered Water Supply,
W87-02609 5F

DONSELMAN, H.
Interactive Effects of Sewage Effluent Irrigation and Supplemental Fertilization on Container-Grown Trees,
W87-02958 3C

DORAN, J. W.
Physical Environment Near the Surface of Plowed and No-Tilled Soils,
W87-03171 2G

DUBETZ, S.
Effect of Irrigation and Nitrogen Fertilizer on the Yield and Protein Content of Soft White Spring Wheat,
W87-02877 3F

DUBOIS, J. D.
Tritium Corrected 14C and Atmospheric Noble Gas Corrected 4He Applied to Deduce Ages of Mixed Groundwaters: Examples from the Baden Region, Switzerland,
W87-03147 5A

DUBREUIL, P. L.
Review of Field Observations of Runoff Generation in the Tropics,
W87-02675 2E

DUCKSON, D. W.
Basin Water Monitoring: Hydrologic Impact or Legal Compliance,
W87-02940 6E

DUKE, C. S.
Effects of Light on Growth, RuBPCase Activity and Chemical Composition of Ulva Species (Chlorophyta),
W87-02809 2L

DUMBROFF, E. B.
Triadimefon Protects Bean Plants from Water Stress through its Effects on Abscisic Acid,
W87-03202 2I

DUNSTAN, M. J.
Ion Exchange Properties of Retorted Rundle Oil Shale,
W87-02707 5B

DURKOP, J.
Interactions between Biotic and Abiotic Factors and Viruses in a Water System,
W87-02657 5B

DZIEGIELEWSKI, B.
Minimizing the Cost of Coping with Droughts: Springfield, Illinois,
W87-03057 6D

DZIEWULSKI, D. M.
Concentration of Seeded and Naturally Occurring Enteroviruses from Waters of Varying Quality by Hollow Fiber Ultrafiltration,
W87-02648 5A

EADIE, B. J.
Partitioning of 7 Beryllium in Fresh Water,
W87-03142 5A

EADS, R. E.
Controlling Suspended Sediment Samplers by Programmable Calculator and Interface Circuitry,
W87-03337 7B

EAGLES, P. M.
Stability of Flows in Channels with Small Wall Curvature,
W87-02863 8B

ECK, H. V.
Profile Modification and Irrigation Effects on Yield and Water Use of Wheat,
W87-02920 3F

EDBERG, S. C.
Phenotypic Characteristics of Coliform and Noncoliform Bacteria from a Public Water Supply Compared with Regional and National Clinical Species,
W87-02894 5A

EDELINE, F.
Anaerobic Treatment of Coke Plant Waste Water,
W87-02783 5D

EDMONDS, W. J.
Characterization and Classification of Seaside-Salt-marsh Soils on Virginia's Eastern Shore,
W87-02919 2L

EGBOKA, B. C. E.
Comparative Analysis of Transmissivity and Hydraulic Conductivity Values from the Ajali Aquifer System of Nigeria,
W87-02859 2F

EGBORGE, A. B. M.
Insecticides and Metals in Nigerian Surface Water - Warri River,
W87-03028 5B

EILERS, H. P.
Environmental Gradients in Northwest Freshwater Wetlands,
W87-02615 2H

EKAMA, G. A.
Kinetics of Biological Phosphorus Release,
W87-02737 5D

EL HOURCH, M.
Sanitary Study of Surface Water and of the Beach of a Water Sports and Leisure Complex,
W87-02777 5B

ELLIOTT, T. C.
Monitoring Pollution,
W87-03117 5A

ELLISON, A. M.
Survivorship and Spatial Development of Spartina alterniflora Loisel. (Gramineae) Seedlings in a New England Salt Marsh,
W87-03096 2L

EMANUEL, K. A.
Possible Role of Symmetric Instability in the Formation of Precipitation Bands,
W87-03213 2B

ERDOGAN, H.
Modeling Leachate Production from Municipal Landfills,
W87-02883 5B

ERMANS, A. M.
Prevention and Treatment of Endemic Iodine-Deficiency Goiter by Iodination of a Municipal Water Supply,
W87-02779 5F

ESSAID, H. I.
Comparison of the Coupled Fresh Water-Salt Water Flow and the Ghyben-Herzberg Sharp Interface Approaches to Modeling of Transient Behavior in Coastal Aquifer Systems,
W87-03077 2F

ESTES, C. C.
Review and Analysis of Methods for Quantifying Instream Flow Requirements,
W87-02933 6D

ETHERINGTON, J. R.
Response to Waterlogging and Differing Sensitivity to Divalent Iron and Manganese in Clones of Dactylis glomerata L. Derived from Well-Drained and Poorly-Drained Soils,
W87-03095 5C

EUBANKS, L. S.
Existence Values and Normative Economics: Implications for Valuing Water Resources,
W87-03188 6B

EUBANKS, R. D.
Bacteria and Viruses in Aerobically Digested Sludge: Influence of Physical and Chemical Treatments on Survival and Association with Flocs under Laboratory Conditions,
W87-02660 5D

EVANGELOU, V. P.
Water Sorption Characteristics of Aluminum- and Calcium-Saturated Soil Clays,
W87-02728 2G

FABER, E.
Biogenic Methane Formation in Marine and Freshwater Environments: CO2 Reduction vs. Acetate Fermentation-Isotope Evidence,
W87-03137 5B

FAHEY, R.
Moving Toward a Coordinated Groundwater Management Approach - A Legislative Proposal,
W87-03315 6E

FAHMY, P. A.
Colorado v. New Mexico II: Judicial Restraint in the Equitable Apportionment of Interstate Waters,
W87-02595 6E

FALLIS, B. W.
Interlaboratory Comparison of Analyses for Heavy Metals in Clam Tissue,
W87-03114 5A

FAPOHUNDA, H. O.
Root Distribution and Water Uptake Patterns of Maize Cultivars Field-Grown under Differential Irrigation,
W87-02817 2I

FARRAH, S. R.
Bacteria and Viruses in Aerobically Digested Sludge: Influence of Physical and Chemical Treatments on Survival and Association with Flocs under Laboratory Conditions,
W87-02660 5D

FATTAL, B.
Analysis of Tap Water for Viruses: Results of a Survey,
W87-02652 5A

FATTICCIONI, H.
Anaerobic Treatment of Coke Plant Waste Water,
W87-02783 5D

FAUP, G.
Polyphosphate Kinase Activity during Phosphate Uptake by Bacteria,
W87-02736 5D

FAUP, G. M.
Importance of the Acidogenic Microflora in Biological Phosphorus Removal,
W87-02749 5D

FAY, P.
Underwater Light Climate and the Growth and Pigmentation of Planktonic Blue-Green Algae (Cyanobacteria) I. The Influence of light quantity,
W87-02908 2H

Underwater Light Climate and the Growth and Pigmentation of Planktonic Blue-green Algae (Cyanobacteria) II. the Influence of Light Quality,
W87-02909 2H

FAYER, M. J.
Air Encapsulation: I. Measurement in a Field Soil,
W87-02915 2G

Air Encapsulation: II. Profile Water Storage and Shallow Water Table Fluctuations,
W87-02916 2F

FEDORAK, P. M.
Effects of Cyanide on the Methanogenic Degradation of Phenolic Compounds,
W87-02709 5D

FEHER, J.
Multivariate Analysis of Quality Parameters to Determine the Chemical Transport in Rivers,
W87-03280 5B

FERGUSON, J. A.
Herbicides and Seeding Rate Effects on Sprinkler-Irrigated Rice,
W87-03013 2I

FERGUSSON, J. E.
Chione (Austrovenus) stutchburyi, a New Zealand Cockle, as a Bio-indicator for Lead Pollution,
W87-02586 5A

FERRARA, R. A.
Role of Detention Basins for Stormwater Quality Control,
W87-03301 5G

FIALA, K.
Distribution and Standing Crop of Living and Dead Roots in Three Wetland Carex Species,
W87-03204 2H

FIELD, J. I.
Effects of Sulphide on Survival of Aero-Aquatic and Aquatic Hyphomycetes,
W87-03174 5C

FIGUEREDO GONZALEZ, R.
Application of Environmental Management Principles in the Program for Eradication of Aedes (Stegomyia) aegypti (Linneus, 1762) in the Republic of Cuba, 1984,
W87-02824 5G

FINNEY, V. L.
Seasonal Sediment Yield to Mark Twain Lake, Missouri,
W87-02789 2J

FIPPS, G.
Drains as a Boundary Condition in Finite Elements,
W87-03201 2F

FISHMAN, M. J.
Evaluation of Methods for Preservation of Water Samples for Nutrient Analysis,
W87-03030 5A

FITZPATRICK, G.
Interactive Effects of Sewage Effluent Irrigation and Supplemental Fertilization on Container-Grown Trees,
W87-02958 3C

FLACK, J.
Tritium Corrected 14C and Atmospheric Noble Gas Corrected 4He Applied to Deduce Ages of Mixed Groundwaters: Examples from the Baden Region, Switzerland,
W87-03147 5A

FLEMING, H. L.
Application of Aluminas in Water Treatment,
W87-02752 5D

FLETCHER, R. A.
Triadimefon Protects Bean Plants from Water Stress through its Effects on Abscisic Acid,
W87-03202 2I

FORSTER, J. W.
Geological Problems Overcome at Revelstoke: Part Two,
W87-02692 8D

FOSTER, I. D. L.
Biogeochemical Controls on River Water Quality in a Forested Drainage Basin, Warwickshire, UK,
W87-03292 2E

FOSTER, J. E.
Lock and Dam 1, Red River Waterway: Hydraulic Model Investigation,
W87-03333 8B

FOUILLAC, C.
Study of Foamy Thermomineral Water of French Massif Central. I. Oxidation-reduction Potential and Behavior of Iron (Etude des eaux Thermominearales Carbogazeuses du Massif Central Francais. I. Potentiel d'Oxydo-Reduction et Comportement du Fer),
W87-03134 5B

Study of Foamy Thermomineral Water of French Massif Central. II. Behavior of Some Trace Metals, Arsenic, Antimony and Germanium, (Etude des Eaux Thermominerales Carbogazeuses du Massif Central Francais. II. Comportement de Quelques Metaux en Trace, de l'Arsenic, de l'Antimoine et du Germanium),
W87-03146 2K

FOULGER, T. R.
Wave Movement and Water-Quality Variations During a Controlled Release from Kielder Reservoir, North Tyne River, U. K.,
W87-02681 2E

FOURNIER, P.
Passive Screen Water Intake Design Studies,
W87-02767 8I

FOX, I.
Review of the Role of Bed Deposits in the Phosphate Eutrophication of Lakes and Rivers,
W87-03022 5B

FOX, L. E.
Chemical Control of Soluble Phosphorus in the Amazon Estuary,
W87-03139 5B

FRANCE, J. W.
RCC: A Dam Rehab Solution Unearthed,
W87-02770 8F

FRANCINGUES, N. R.
Identification of Promising Concepts for Treatment of Contaminated Sediments,
W87-03256 5D

FRANK, A. B.
Estimation of Spring Wheat Spike Water Concentration and Grain Maturity from Air Temperature,
W87-02998 2I

FRANKLIN, S. L.
Evaluation of Weekly and Monthly Time Series Forecasts of Municipal Water Use,
W87-02629 6A

FRASER, H. G.
Meteorological Data Analysis for Drainage System Design,
W87-02882 2B

FRICK, H.
Boron Tolerance and Accumulation in the Duckweed, Lemna minor,
W87-03152 5C

Micronutrient Tolerance and Accumulation in the Duckweed, Lemna,
W87-03153 5C

FRIEDMAN, B.
Interactions between Biotic and Abiotic Factors and Viruses in a Water System,
W87-02657 5B

FRITTON, D. D.
Soil Potential Ratings for Onsite Wastewater Disposal,
W87-02860 5E

FROEHLICH, W.
Mechanisms of Dissolved Solids Transport in Flysch Drainage Basins,
W87-03281 5B

FU, W. Y.
Waterhammer Pressure Compensation in Turbine Regulating Systems,
W87-02690 8C

FUHRER, J.
Study of Acid Deposition in Switzerland: Temporal Variation in the Ionic Composition of Wet Precipitation at Rural Sites During 1983-1984,
W87-02763 5B

FUJII, S.
Rational Allocation of Monitoring Stations in a Lake by Means of the Spline Technique,
W87-02598 7A

FUJITA, Y.
Chromatic Regulation of Photosystem Composition in the Photosynthetic System of Red and Blue-Green Algae,
W87-03212 2H

FUKASE, T.
Factors Affecting Biological Removal of Phosphorus,
W87-02748 5D

FUKUI, M.
Continuous Monitoring of 222Rn Concentration in Unconfined Groundwater,
W87-02847 5A

FUKUOKA, J.
Modelling of the Lower Trophic Levels of a Marine Ecosystem and Its Example of Short-period Variations of Chlorophyll and Nutrient in Harima-Nada,
W87-02601 2L

FUKUSHIMA, T.
Box Model for Prediction of Water Quality in Eutrophic Lakes,
W87-02972 2H

FULLEN, M. A.
Compaction, Hydrological Processes and Soil Erosion on Loamy Sands in East Shropshire, England,
W87-03160 2J

FURLONG, E. A.-N.
Trihalomethane Levels in Chlorinated Michigan Drinking Water,
W87-02605 5F

GABRIELS, R.
Effect of Short-term Water Stress on Leaf Gas Exchange Processes and Plant Water Potential in Schefflera,
W87-03104 2I

GALLEGO, M.
Indirect Atomic Absorption Determination of Anionic Surfactants in Wastewaters by Flow Injection Continuous Liquid-Liquid Extraction,
W87-03048 5A

GAMBLE, J.
Trickle Irrigation System for Recycling Residential Wastewater on Fruit Trees,
W87-02955 3C

GARAY, A. F.
Water Use Efficiency in Soybean Pubescence Density Isolines-A Calculation Procedure for Estimating Daily Values,
W87-03000 2I

GARDNER, B. D.
Distribution of Economic Rents Arising from Subsidized Water When Land is Leased,
W87-02874 6C

GARIE, H. L.
Distribution of Benthic Macroinvertebrates in a Stream Exposed to Urban Runoff,
W87-02939 5C

GARKLAVS, G.
Effect of Rainfall Excess Calculations on Modeled Hydrograph Accuracy and Unit-Hydrograph Parameters,
W87-02623 2B

GARNETT, K.
Nitrilotriacetic Acid in Sludge-amended Soil: Mobility and Effects on Metal Solubility,
W87-02765 5E

GAUGUSH, R. F.
Statistical Methods for Reservoir Water Quality Investigations,
W87-03322 7C

GAVAGHAN, H.
Time and Tide Are Right for the Severn Barrage,
W87-03091 8A

GELHAR, L. W.
Observations of Spatial Variability of Soil-Water Pressure in a Field Soil,
W87-02713 2G

GELLIS, A. J.
Water Supply in the Northeast: A Study in Regulatory Failure,
W87-02590 6E

GENDRON, A.
Early Diagenesis of Cadmium and Cobalt in Sediments of the Laurentian Trough,
W87-03138 5B

GEORGE, J.
Acute and Chronic Toxicity of Nickel to Larvae of Chironomus riparis (Meigen),
W87-03083 5C

GEORGIOU, G. A.
Stability of Flows in Channels with Small Wall Curvature,
W87-02863 8B

GERARDI, M. H.
Operator's Guide to Protozoa and their Role in the Activated Sludge Process,
W87-02903 5D

GERBA, C. P.
Detection of Rotavirus in Treated Drinking Water,
W87-02643 5B

Use of Geostatistics to Predict Virus Decay Rates for Determination of Septic Tank Setback Distances,
W87-02895 5B

GERMANN, P. F.
Distribution Function Approach to Water Flow in Soil Macropores Based on Kinematic Wave Theory,
W87-02858 2G

GERSBERG, R. M.
Phosphorus Uptake by Klebsiella pneumoniae and Acinetobacter calcoaceticus,
W87-02741 5D

GETOFF, N.
Radiation Induced Decomposition of Some Chlorinated Methanes in Water,
W87-02702 5D

GIBBS, P. E.
Decline of the Gastropod Nucella lapillus Around South-West England: Evidence for the Effect of Tributyltin from Antifouling Paints,
W87-03053 5C

GIESKE, A.
Analysis of Earth-Tide-Induced Groundwater Flow in Eastern Botswana,
W87-02840 2F

GILMOUR, J. T.
Herbicides and Seeding Rate Effects on Sprinkler-Irrigated Rice,
W87-03013 2I

GILVEAR, D. J.
Wave Movement and Water-Quality Variations During a Controlled Release from Kielder Reservoir, North Tyne River, U. K.,
W87-02681 2E

GIRAULT, P.
Economy and Performance of Small Turbines, (Economie et Performance des Petites Turbines),
W87-02570 8C

GIUSTI, G.
Distribution of Anionic Surfactants in the Water Column of the Gulf of Fos-sur-Mer, (Distribution des Detergents Anioniques dans la Colonne d'Eau du Golfe de Fos-sur-Mer),
W87-02563 5B

GLENN, S.
Nonpoint Source Loading of Phenolic Acids from Decomposing Crop Residue,
W87-03161 5B

GLOVER, J. E.
Lock and Dam 1, Red River Waterway: Hydraulic Model Investigation,
W87-03333 8B

GODA, T.
Eutrophication Model of Lake Kasumigaura,
W87-02971 2H

Synthesis and Analysis of a Comprehensive Lake Model - With the Evaluation of Diversity of Ecosystems,
W87-02965 2H

GOETTEMOELLER, R. L.
Ohio Water Law: Present Aspects of Ohio Water Policy,
W87-03313 6E

GOL'TSOV, S. N.
Two-Chamber Consolidation Press,
W87-03183 8D

GOLDSMITH, C. D.
Biodegradation of Methanol and Tertiary Butyl Alcohol in Subsurface Systems,
W87-02732 5B

GOLIMOWSKI, J.
Trace Determination of Chromium in Various Water Types by Adsorption Differential Pulse Voltammetry,
W87-02797 5A

GONWA, W. S.
Modified Diffusion Equation for Flood Propagation in Trapezoidal Channels,
W87-02855 2E

GORENKO, A. V.
Restoration of Pipe Drainage in Foundations of Hydraulic Structures on Carbonate Rocks,
W87-03184 8A

GORHAM, J.
Salt Tolerance in the Triticeae: Salinity-Induced Changes in the Leaf Solute Composition of Some Perennial Triticeae,
W87-02785 2I

GOSSE, PH.
Effects of Hydraulic Projects and Their Management on Water Quality,
W87-03297 6G

GOULD, J.
Lessons from Field Experience with Rainwater Collection Systems in Africa and Asia,
W87-03042 5F

GOYENECHE, O.
Metabolical Activity of Bacteria in Geothermal Spring-waters Dating from Dogger and Trias Periods in the Bassin Parisien, (Activites Metaboliques des Bacteries des Eaux Geothermales du Dogger et du Trias du Bassin Parisien),
W87-02562 5B

GOYKE, T.
Improved Method for Recovery of Enteric Viruses from Wastewater Sludges,
W87-02710 5A

GRABOW, W. O. K.
Practical Direct Plaque Assay for Coliphages in 100-ml Samples of Drinking Water,
W87-02890 5A

GRAHAM, B. W.
Retardation of Toxic Chemicals in a Contaminated Outwash Aquifer,
W87-02731 5B

GRANAT, L.
Deposition of Atmospheric Trace Metals in Northern Sweden as Measured in the Snowpack,
W87-02720 5B

GRAS, R.
Effects of Hydraulic Projects and Their Management on Water Quality,
W87-03297 6G

GRATTAN, S. R.
Root Control of Leaf Phosphorus and Chlorine Accumulation in Soybean Under Salinity Stress,
W87-02984 2I

GREATHOUSE, W.
Professional Tank Cleaning Can Make a Difference,
W87-03080 5D

GREEN, I. R. A.
Explicit Solution of the Modified Horton Equation,
W87-02850 2G

GREENFIELD, P. F.
Ion Exchange Properties of Retorted Rundle Oil Shale,
W87-02707 5B

GREENWOOD, E. A. N.
Evaporation from the Understorey in the Jarrah (Eucalyptus Marginata Don Ex Sm.) Forest, Southwestern Australia,
W87-02679 2D

GREER, D. H.
Effects of Carbon Dioxide Enrichment and Soil Water on Maize,
W87-03002 2I

GRIBAR, J. C.
Selective Withdrawal From Any Level Between Minimum Pool and Spillway Elevation at Stonewall Jackson Dam, West Virginia,
W87-03245 8A

GRICE, S. S.
Atmospheric Methane Sources: Alaskan Tundra Bogs, an Alpine Fen, and a Subarctic Boreal Marsh,
W87-02719 5B

GRIEVE, I. C.
Biogeochemical Controls on River Water Quality in a Forested Drainage Basin, Warwickshire, UK,
W87-03292 2E

GRILLOT, J. C.
Evolution in Space and Time of an Alluvial Aquifer under the Effect of an Exceptional Multi-Year Drought (Mediterranean Shore, Herault, France) (Evolution Spatio-Temporelle d'un Aquifere Alluvial sous l'Effet d'une Secheresse Pluriannuelle Exceptionnelle (Littoral Mediterraneen, Herault, France)),
W87-02838 2F

GROBLER, D. C.
Assessment of the Impact of Eutrophication Control Measures on South African Impoundments,
W87-02973 5G

GROMIEC, M. J.
Effect of Seawater on Nitrification by Attached Biofilm,
W87-02603 5D

GROSS, M. F.
Biomass and Structure of a Spartina alterniflora Loisel.-dominated Salt Marsh in France,
W87-03203 2L

GROZNOV, B. M.
Low-Head Pumped-Storage Station as a Way of Expanding the Tsimlyansk Hydroelectric Station,
W87-03182 8C

GRUNER, J.
Automation of a Chain of Run-of-River Power Stations,
W87-03035 8C

GRUNWALD, G. K.
Effect of Standing Small Grain Stubble on Snow Cover Characteristics in Alternate Fallow Strip Cropping,
W87-02990 2C

GULLIVER, J. S.
Designing Intakes to Avoid Free-Surface Vortices,
W87-03034 8B

GUNNISON, D.
Effectiveness of Capping in Isolating Dutch Kills Sediment from Biota and the Overlying Water,
W87-03332 5G

GUPTA, C. P.
Compaction and Tillage Depth Combinations for Water Management and Rice Production in Low-Retentive Permeable Soils,
W87-03163 3F

GUPTA, G. K.
Effect of Tillage and Mulching on Soil Environment and Cowpea Seedling Growth Under Arid Conditions,
W87-03166 3F

GUPTA, J. P.
Effect of Tillage and Mulching on Soil Environment and Cowpea Seedling Growth Under Arid Conditions,
W87-03166 3F

GUTTMAN-BASS, N.
Analysis of Tap Water for Viruses: Results of a Survey,
W87-02652 5A

Humic Acid Interference with Virus Recovery by Electropositive Microporous Filters,
W87-02900 5A

GUVEN, O.
Deterministic and Stochastic Analyses of Dispersion in an Unbounded Stratified Porous Medium,
W87-03196 5B

HAAR, H. R.
Principles and Practices for the Ocean Disposal of Dredged Material: The London Dumping Convention Re-Examined,
W87-03267 5E

HAGEBRO, C.
Nitrate Load/Discharge Relationships and Nitrate Load Trends in Danish Rivers,
W87-03302 5B

HAGGIN, J.
More Awareness Sought Concerning Role of Metals in Pollution,
W87-02791 5B

HAINES, B.
Rates of Mineral Element Leaching from Leaves of Nine Plant Species from a Southern Appalachian Forest Succession Subjected to Simulated Acid Rain,
W87-03206 5C

HALEY, M. V.
Toxicity of Brass Dust to the Microalgae Ankistrodesmus falcatus and Selenastrum capricornutum,
W87-02778 5C

HALL, B.
Risk Information for Floodplain Management,
W87-03061 6F

HALL, D. R.
County's Search for Long-Term Water Supply Pays Off,
W87-03119 5F

HALL, F.
Hydraulic Design of the Selective Withdrawal Structures at the Elk Creek Dam,
W87-03225 8A

Hydraulic Design of the Selective Withdrawal Structures of the Applegate Dam,
W87-03224 8A

Hydraulic Design of the Selective Withdrawal Structures of the Lost Creek Dam,
W87-03223 8A

HALL, P. O. J.
Benthic Fluxes of Cadmium, Copper, Nickel, Zinc and Lead in the Coastal Environment,
W87-03144 5B

Effect of Oxygen on Release and Uptake of Cobalt, Manganese, Iron and Phosphate at the Sediment-Water Interface,
W87-03143 5B

HAMILL, L.
Chubb/Bauman Method for Estimating the Recreation Potential of Rivers: A Critical Review,
W87-02634 6A

HAMMER, C.
Placers of Cosmic Dust in the Blue Ice Lakes of Greenland,
W87-02913 2C

HAMMER, M. J.
Need for Fluoridation of Desalinated Water Supplies,
W87-03041 5F

HAMMER, P. A.
Growth and Nutritional Status of Petunia and Tomato Seedlings with Acidified Irrigation Water,
W87-03105 5C

HAMMES, D. C.
Waterford Treatment Plant - A Small Town Lagoon System,
W87-02834 5D

HAMMOND, L. C.
Interactive Effects of Nitrogen and Water Stresses on Water Relations of Field-Grown Corn Leaves,
W87-02994 2I

HANAFY, M. S.
Meteorological Data Analysis for Drainage System Design,
W87-02882 2B

HANAKI, K.
Effect of Seawater on Nitrification by Attached Biofilm,
W87-02603 5D

HANG, A. N.
Responses of Sugarbeet to Deficit, High-Frequency Sprinkler Irrigation. I. Sucrose Accumulation, and Top and Root Dry Matter Production,
W87-02985 3F

Responses of Sugarbeet to Deficit, High-Frequency Sprinkler Irrigation. II. Sugarbeet Development and Partitioning to Root Growth,
W87-02986 3F

Yield and Physiological Responses of Potatoes to Deficit, High Frequency Sprinkler Irrigation,
W87-02997 3F

HANG, W.
Public Policy Implications of Toxic Chemicals in Drinking Water: A Case Study of Long Island, NY,
W87-02826 5C

HANNAH, R. E.
HPLC Anion Exclusion Method for Fluoride Determinations in Complex Effluents,
W87-03094 5A

HANSEN, E. M.
Evolution of PMP Cooperative Studies,
W87-03063 8A

HANSEN, K. D.
RCC: A Dam Rehab Solution Unearthed,
W87-02770 8F

HANSON, J. R.
Ohio Water Law: The Present,
W87-03310 6E

HAO, O. J.
Starch Waste Treatment by the Activated Sludge System,
W87-02705 5D

HAQ, I.
Association Between Some Planktonic Species and Physicochemical Characteristics of the Water of Loktak Lake, Manipur, India,
W87-03025 2H

HARASHIMA, A.
Interaction Between Motile Phytoplankton and Langmuir Circulation,
W87-02969 2L

HARBAUGH, B. K.
Interactive Effects of Trickle Irrigation Rates, Cultivars, and Culture on Cut Chrysanthemum,
W87-02959 3F

HARDISTY, M. W.
Seasonal Abundance, Growth, Feeding and Age Composition of Flounder (Platichthys flesus (L.)) Populations of the Severn Estuary and Bristol Channel,
W87-03027 2L

HARIK, S. N.
Soil Application of a Hydrophilic Conditioner in Relation to Moisture, Irrigation Frequency and Crop Growth,
W87-02881 3F

HARISH, C. M.
Spectral and Statistical Characteristics of Shallow Water Waves,
W87-03218 8B

HARMS, U.
Multielement Trace Preconcentration from Water on Activated Carbon for the Sample Pretreatment for Atomic Spectroscopy (Flame-AAS, ICP/OES), (Multielement-Spurenanreicherung aus Wassern an Aktivkohle zur Probenvorbereitung fur die Atomspektroskopie (Flammen-AAS, ICP/OES)),
W87-02799 5A

Possibilities of Improving the Determination of Extremely Low Lead Concentrations in Marine Fish by Graphite Furnace Atomic Absorption Spectrometry,
W87-02794 5A

HARRIS, T. R.
Stochastic Dominance Comparison of Water-Conserving Irrigation Strategies,
W87-02873 3F

HARRISON, D. C.
National Water Policy -- Does Anybody Want One,
W87-02619 6E

HARRISON, H. C.
Response of Lettuce Cultivars to Sludge-Amended Soils and Bed Types,
W87-02880 3C

HARRISS, R. C.
Atmospheric Methane Sources: Alaskan Tundra Bogs, an Alpine Fen, and a Subarctic Boreal Marsh,
W87-02719 5B

HART, B. T.
Nutrient and Trace Metal Fluxes in the Magela Creek System, Northern Australia,
W87-02974 2E

HART, E. D.
Field Measurements at Intake Structures,
W87-03240 8B

HART, G. S.
Toxicity of Brass Dust to the Microalgae Ankistrodesmus falcatus and Selenastrum capricornutum,
W87-02778 5C

HARTEMANN, P.
Study of Indigenous Virus Removal at Different Stages in a Drinking Water Plant Treating River Water,
W87-02665 5F

HARTMAN, W. A.
Effects of Four Agricultural Pesticides on Daphnia pulex, Lemna minor, and Potamogeton pectinatus,
W87-02589 5C

HARTWELL, T.
Concentrations of 20 Volatile Organic Compounds in the Air and Drinking Water of 350 Residents of New Jersey Compared with Concentrations in Their Exhaled Breath,
W87-02774 5B

HARVEY, M. D.
Fluvial Processes and Morphological Thresholds in Incised Channel Restoration,
W87-02930 2J

HARWELL, C. C.
Ecology and Estuarine Impact Assessment: Lessons Learned from the Hudson River (U.S.A.) and Other Estuarine Experiences,
W87-02776 2L

HASEK, R. F.
Water Conservation and Recycling in Ornamentals Production,
W87-02957 3F

HASHOLT, B.
Dissolved and Particulate Load in Danish Water Courses,
W87-03293 5B

HASSEN, A.
Study of Indigenous Virus Removal at Different Stages in a Drinking Water Plant Treating River Water,
W87-02665 5F

HASSIDIM, M.
Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: I. Salinity During Growth Modulates the Proton Pump in the Halophyte Atriplex Nummularia,
W87-02717 2I

Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: II. K(+) Strongly Promotes Development of Membrane Potential in Vesicles from Cotton Roots,
W87-02718 2I

HATCHER, P. G.
Dissolved Organic Matter in Anoxic Pore Waters from Mangrove Lake, Bermuda,
W87-03136 5A

HATTON, C. J.
Biological Phosphorus and Nitrogen Removal at an Experimental Full Scale Plant in the U.K.,
W87-02750 5D

HAWLEY, N.
Partitioning of 7 Beryllium in Fresh Water,
W87-03142 5A

HAY, R. K. M.
Microclimate of an Upland Grassland,
W87-03101 2I

HAYASE, K.
Determination of Organically-associated Trace Metals in Estuarine Sea-Water by Solvent Extraction and Atomic-Absorption Spectrometry,
W87-03173 5A

HEBSON, C. S.
Hydrologic Similarity: 1. Derivation of the Dimensionless Flood Frequency Curve,
W87-03194 2E

HEEDE, B. H.
Designing for Dynamic Equilibrium in Streams,
W87-02929 2E

HEIDTKE, T. M.
Effect of Influent Phosphorus Reductions on Great Lakes Sewage Treatment Costs,
W87-02630 5D

HEJZLAR, J.
Microbial Polymers in the Aquatic Environment-I: Production by Activated Sludge Microorganisms under Different Conditions,
W87-02694 5D

Microbial Polymers in the Aquatic Environment-II: Isolation from Biologically Non-purified and Purified Municipal Waste Water and Analysis,
W87-02695 5D

Microbial Polymers in the Aquatic Environment-III: Isolation from River, Potable and Underground Water and Analysis,
W87-02696 5B

HELLER, S. A.
Anomalous Natural Sulfate in Water Wells of the Greenbrier Group, West Virginia,
W87-02625 5B

HELMS, J. W.
Operation of Selective Withdrawal Facilities: Libby Dam, Montana,
W87-03227 5C

HELZ, G. R.
Two-Method Verification of Hydrogen Peroxide Determinations in Natural Waters,
W87-03050 5A

HEMMER, G. L.
Interim Progress Report, Volume I: SCPP Meteorological and Statistical Support for Period 1 September 1984 through 31 August 1985,
W87-03327 2B

HENDERSON, J. E.
Environmental Designs for Streambank Protection Projects,
W87-02621 6G

HENDERSON, L. J.
Influence of Soil Structure on Movement Rate of Salts Through Soils,
W87-02716 5B

HENDRICKS, D. W.
Slow Sand Filtration: Influences of Selected Process Variables,
W87-02611 5F

HENDRIX, D. L.
Accumulation and Turnover of Abscisic Acid in Osmotically Stressed Cotton Leaf Tissue in Relation to Temperature,
W87-03216 2I

HENDZEL, M. R.
Interlaboratory Comparison of Analyses for Heavy Metals in Clam Tissue,
W87-03114 5A

HENRY, J. P.
Small Hydroelectric Plants and Environemental Protection, (Petite Hydraulique et Protection de l'Environment),
W87-02573 8C

HENSEY, M. P.
Zooplankton Fauna of Killary Harbour: The Seasonal Cycle of Abundance,
W87-03054 2L

HERBERT, R.
New Analogue Computer for the Study of Pumping Tests under Falling Water-Table Conditions,
W87-02854 7B

HERBOLD, B.
Patterns in Distribution and Abundance of a Noncoevolved Assemblage of Estuarine Fishes in California,
W87-02758 2L

HETLING, L. J.
Toxic Substances, Risk Management and New York State Drinking Water,
W87-02832 5B

HEUMANN, K. G.
Determination of Lead, Cadmium and Thallium in Water Samples at ppb and ppt Levels by Isotope Dilution Mass Spectrometry, (Bestimmung von Blei, Cadmium und Thallium in Wasserproben im ppb- und ppt-Bereich durch massenspektrometrische Isotopenverdunnungsanalyse),
W87-02795 5A

HEYSE, E.
In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-02754 5G

HIGASHI, S.
Bioaccumulation of Arsenic by Freshwater Algae and the Application to the Removal of Inorganic Arsenic from an Aqueous Phase: Part II. by Chlorella vulgaris Isolated from Arsenic-Polluted Environment,
W87-02907 5B

HILLEL, D.
Air Encapsulation: I. Measurement in a Field Soil,
W87-02915 2G

Air Encapsulation: II. Profile Water Storage and Shallow Water Table Fluctuations,
W87-02916 2F

HIRATSUKA, S.
Interactive Algorithm for the Parameter Estimation of Complex Systems and Its Application to an Ecological Modelling of an Actual Japanese Lake,
W87-02600 2H

HOBSON, T.
$5.00, 1-Minute Effluent Quality Tester,
W87-02814 7B

Measuring Sludge Concentration and Quality,
W87-02835 5D

HODGES, C. F.
Differential Sensitivity of Turfgrass Organs to Water Stress,
W87-02962 2I

HODGKISS, M. T.
Genomic Analysis of RNA Viruses Isolated from Water,
W87-02645 5A

HOENIGER, J. F. M.
Decomposition Studies in Two Central Ontario Lakes Having Surficial pHs of 4.6 and 6.6,
W87-02897 2H

HOEPPEL, R. E.
Effectiveness of Capping in Isolating Dutch Kills Sediment from Biota and the Overlying Water,
W87-03332 5G

HOFSTRA, G.
Triadimefon Protects Bean Plants from Water Stress through its Effects on Abscisic Acid,
W87-03202 2I

HOGARTH, W. L.
Comparison of Steady Infiltration Solutions for Spherical Cavities Under Simple Versus Variable Hydraulic Properties,
W87-02712 2G

HOLLAND, J. P.
Design of Selective Withdrawal Intake Structures,
W87-03237 8A

Operational Tools: Selective Withdrawal and Daily Operational Strategy,
W87-03238 5G

HOOGENBOOM, G.
Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-03010 2I

HOPE, S. J.
Constructing a Better Environment,
W87-03126 5G

HOPMANS, J. W.
Combined Effect of Hysteresis and Temperature on Soil-Water Movement,
W87-02857 2G

Temperature Dependence of Soil Water Retention Curves,
W87-02914 2G

HORIE, T.
Numerical Prediction on the Effect of Phosphorus Release Control by Sediment Dredging,
W87-03253 5B

HORIHAN, L. S.
Bloomington Dam, Potomac River Water Quality Outlet,
W87-03231 5G

Water Quality Outlet Warm Springs Dam,
W87-03232 5G

HORWOOD, L. J.
Exposure to Fluoridated Public Water Supplies and Child Health and Behaviour,
W87-03092 5C

HOSKING, J. R. M.
Unbiased Plotting Positions for the General Extreme Value Distribution,
W87-03071 2E

Value of Historical Data in Flood Frequency Analysis,
W87-03200 2E

HOSOMI, M.
Model of Nitrogen Release from Bottom Sediments,
W87-03250 5B

HOWARD, C. D. D.
Meteorological Data Analysis for Drainage System Design,
W87-02882 2B

HOWINGTON, S.
Blending in a Single Wet Well,
W87-03236 5G

HRUDEY, S. E.
Effects of Cyanide on the Methanogenic Degradation of Phenolic Compounds,
W87-02709 5D

HSIEH, P. A.
New Formula for the Analytical Solution of the Radial Dispersion Problem,
W87-03199 2F

HSUEH, K. P.
Starch Waste Treatment by the Activated Sludge System,
W87-02705 5D

HUBBARD, S. D.
Maryland's Phosphate Ban-History and Early Results,
W87-02819 5G

HUCK, M. G.
Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-03010 2I

HUDON, P.
Self-closing Cylindrical Gate Improves Safety at Low Cost,
W87-02693 8C

HUDSON-BARUTH, B. A.
Adsorption of Select Phenol Derivatives by Dolomite,
W87-02583 5B

HUFFAKER, R. G.
Distribution of Economic Rents Arising from Subsidized Water When Land is Leased,
W87-02874 6C

HUGGINS, A. W.
Interim Progress Report, Volume I: SCPP Meteorological and Statistical Support for Period 1 September 1984 through 31 August 1985,
W87-03327 2B

HULUGALLE, N. R.
Soil Water Balance of Intercropped Maize and Cowpea Grown in a Tropical Hydromorphic Soil in Western Nigeria,
W87-02989 2I

HUMMERSTONE, L. G.
Decline of the Gastropod Nucella lapillus Around South-West England: Evidence for the Effect of Tributyltin from Antifouling Paints,
W87-03053 5C

HUNT, B.
Simple Approximation for a Moving Interface in a Coastal Aquifer,
W87-02851 2F

HUNTSMAN, S. A.
Relationships Among Growth Rate, Cellular Manganese Concentrations and Manganese Transport Kinetics in Estuarine and Oceanic Species of the Diatom Thalassiosira,
W87-02805 2L

HURLEY, B.
Biological Phosphorus and Nitrogen Removal at an Experimental Full Scale Plant in the U.K.,
W87-02750 5D

HURST, C. J.
Improved Method for Recovery of Enteric Viruses from Wastewater Sludges,
W87-02710 5A

HUSBANDS, T. B.
Latex Admixtures for Portland Cement Concrete and Mortar,
W87-03318 8G

HUTTON, S. P.
Improved Monitoring of Air in Water,
W87-03038 7B

HUVET, P.
Influence of the Runner Blade Angle Variation on Kaplan Turbine Transients, (Influence de la Variation d'Inclinaison des Pales sur les Regimes Transitoires des Turbines Kaplan),
W87-02579 8C

HVITVED-JACOBSEN, T.
Nutrient Transformation in Retention/Detention Ponds Receiving Highway Runoff,
W87-02821 5D

HYLTON, C. M.
Alcohol Dehydrogenase Activity in the Roots of Marsh Plants in Naturally Waterlogged Soils,
W87-02816 2I

ICHIKAWA, A.
Modeling for Estimating Representative Water Conditions in a River Basin,
W87-02604 5B

IKEDA, T.
Legal System and Works for Preservation of the Port, Harbour, and Marine Environment in Japan,
W87-03249 5G

ILCHEVA, L.
Flow Injection Analysis of Chloride in Tap and Sewage Water Using Ion-Selective Electrode Detection,
W87-02798 5A

ILHAT, D.
Analysis of Transient Phenomena in Hydroelectric Generation Plants, (Calcul des Transitoires dans les Installations Hydrauliques de Production d'Energie),
W87-02580 8C

IMPENS, I.
Effect of Short-term Water Stress on Leaf Gas Exchange Processes and Plant Water Potential in Schefflera,
W87-03104 2I

INGRAHAM, N. L.
Hydrogen Isotope Study of Large-Scale Meteoric Water Transport in Northern California and Nevada,
W87-02686 2F

INGRAM, H. A. P.
Non-Darcian Transmission of Water in Certain Humified Peats,
W87-02846 2G

INOUE, H.
65 MW Bulb Turbine for Japan's Tadami Project,
W87-02691 8C

INOUE, T.
Progressive Trenching Using a Scraper Digger,
W87-03268 5E

INOUE, Y.
Effect of O2 Concentration on Dark H2 Oxidation in Whole Cells of a Marine Sulfur Photosynthetic Bacterium (Chromatium sp. Strain Miami PBS 1071),
W87-03211 2L

IRGOLIC, K. J.
Health Effects of Arsenic in the Aqueous Environment,
W87-02833 5C

IRVIN, P.
Modeling North Cascades Annual Runoff Distribution Using Drainage Basin Elevation Distribution,
W87-02627 2E

ISAACS, L. T.
Simple Approximation for a Moving Interface in a Coastal Aquifer,
W87-02851 2F

ISAACSON DE S, M.
Recent Advances in the Computation of Nonlinear Wave Effects on Offshore Structures,
W87-02668 8B

ITTEKKOT, V.
Nature of Particulate Organic Matter in the River Indus, Pakistan,
W87-03148 5A

IVERFELDT, A.
Benthic Fluxes of Cadmium, Copper, Nickel, Zinc and Lead in the Coastal Environment,
W87-03144 5B

Effect of Oxygen on Release and Uptake of Cobalt, Manganese, Iron and Phosphate at the Sediment-Water Interface,
W87-03143 5B

IVERSON, R. M.
Groundwater Seepage Vectors and the Potential for Hillslope Failure and Debris Flow Mobilization,
W87-03193 2F

JACKSON, R. E.
Retardation of Toxic Chemicals in a Contaminated Outwash Aquifer,
W87-02731 5B

JACKSON, T.
Waterford Treatment Plant - A Small Town Lagoon System,
W87-02834 5D

JACOBS, A. F. G.
Evaporation Data from a Capillary Evaporimeter,
W87-03073 7B

JACOBS, A. M.
Borehole Television for Geotechnical Investigations,
W87-03032 7B

JACQUET, B.
Large Pelton Turbines for Canada's Cat Arm Scheme,
W87-02688 8C

JAFFE, F. C.
Tritium Corrected 14C and Atmospheric Noble Gas Corrected 4He Applied to Deduce Ages of Mixed Groundwaters: Examples from the Baden Region, Switzerland,
W87-03147 5A

JAMES, A.
Modeling of Pollutant Dispersion in Stratified Oscillatory Flows,
W87-02885 5B

JAMES, L. D.
Risk Information for Floodplain Management,
W87-03061 6F

JAMES, S. C.
In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-02754 5G

JAN, E. -Z.
Inexpensive System Using Drip-Emitters for Irrigating Small Plots,
W87-02876 3F

JAYASENA, H. A. H.
Groundwater Occurrences in the Hard Rock Terrains of Sri Lanka - A Case Study,
W87-03047 2F

JAYNES, D. B.
Percolation of Water Below an Irrigated Field,
W87-02722 5B

JEPSEN, C. P.
Innovative Lagoon Liner Pays Off,
W87-03078 5D

JIMENEZ, B. D.
Anomalous Binding of Organic Contaminants May Be Artifactual Due to Radiochemical Impurities,
W87-02700 5A

JO, N.
Modelling of Industrial Ecological Systems for Evaluation of Health Services,
W87-02979 4C

JOHNSON, D. R.
Selective Withdrawal Needs for Lake Greeson Arkansas Intake Structure,
W87-03242 5G

JOHNSON, D. W.
Toxicity of Brass Dust to the Microalgae Ankistrodesmus falcatus and Selenastrum capricornutum,
W87-02778 5C

JOLLIFF, G. D.
Growth and Yield of Sunflower and Soybean Under Soil Water Deficits,
W87-02992 2I

Irrigation Effects on Agronomic Characters of Meadowfoam,
W87-02995 3F

JONES, E. R.
Maryland's Phosphate Ban-History and Early Results,
W87-02819 5G

JONES, G. L.
Radionuclide Concentrations in Louisiana Soils and Sediments,
W87-03085 5B

JONES, J. W.
Interactive Effects of Nitrogen and Water Stresses on Water Relations of Field-Grown Corn Leaves,
W87-02994 2I

JONES, O. R.
Response of Conservation Tillage Sorghum to Growing Season Precipitation,
W87-03167 3F

JONES, R. G.
Salt Tolerance in the Triticeae: Salinity-Induced Changes in the Leaf Solute Composition of Some Perennial Triticeae,
W87-02785 2I

JONES, V. J.
Lake Acidification and the Land-Use Hypothesis: A Mid-Post-Glacial Analogue,
W87-02810 2K

JONSSON, I. G.
Bed Friction and Dissipation in a Combined Current and Wave Motion,
W87-03210 8B

JORET, J. C.
Study of Indigenous Virus Removal at Different Stages in a Drinking Water Plant Treating River Water,
W87-02665 5F

JORGENSEN, P. H.
Detection and Stability of Enteric Viruses in Sludge, Soil and Ground Water,
W87-02662 5B

Examination of the Penetration of Enteric Viruses in Soils under Simulated Conditions in the Laboratory,
W87-02663 5B

JORGENSEN, S. E.
Validation of a Prognosis Based Upon a Eutrophication Model,
W87-02602 5C

JOSHI, A. J.
Effects of Seawater on Amino Acids and Mineral Ions Composition in Salicornia brachiata Roxb,
W87-03093 3C

JOSHI, V. G.
Results of Pumping Tests in the Deccan Trap Basalts of Central India,
W87-03076 2F

JOUBERT, W. A.
Effect of Effluent Recirculation on the Performance of a Two Stage Anaerobic Process,
W87-03088 5D

JUREY, C. D.
Effect of Cultivated and Wild Rice Varieties on the Nitrogen Balance of Flooded Soil,
W87-02813 2I

KAEMPFER, C.
Biological Phosphorus Removal: A Technology Evaluation,
W87-02820 5D

KALAFATOGLU, H.
Determination of Pollution and Eutrophic Conditions of Sapanca Lake (Turkey),
W87-02587 5B

KALFF, J.
Effect of Catchment Size on Phosphorus Export,
W87-02941 5B

KAMON, M.
Lime-Cement Hardening of Very Soft Freshwater Clay,
W87-03260 8D

KAMP-NIELSEN, L.
Validation of a Prognosis Based Upon a Eutrophication Model,
W87-02602 5C

KAMYKOWSKI, D. L.
Effects of Temperature, Salinity, Irradiance and Diurnal Periodicity on Growth and Photosynthesis in the Diatom Nitzschia americana: Light-Saturated Growth,
W87-02807 2L

KANEKO, M.
Virus Removal by Activated Sludge Treatment,
W87-02658 5D

KANEMASU, E. T.
Procedure to Select Drought-Tolerant Sorghum and Millet Genotypes Using Canopy Temperature and Vapor Pressure Deficit,
W87-03001 2I

Remote Sensing Techniques for Assessing Water Deficits and Modeling Crop Response,
W87-02953 7B

KANWAR, R. S.
Alternatives to the Use of Agricultural Drainage Wells,
W87-02624 4B

KAR, S.
Compaction and Tillage Depth Combinations for Water Management and Rice Production in Low-Retentive Permeable Soils,
W87-03163 3F

KARATHANASIS, A. D.
Water Sorption Characteristics of Aluminum- and Calcium-Saturated Soil Clays,
W87-02728 2G

KARLIN, E. F.
Vegetation of the Low-Shrub Bogs of Northern New Jersey and Adjacent New York: Ecosystems at their Southern Limit,
W87-03208 2H

KAUFMANN, R. S.
137C-135C Variations in a Diffusion-Controlled Groundwater System,
W87-03149 5A

KAVVAS, M. L.
Modified Diffusion Equation for Flood Propagation in Trapezoidal Channels,
W87-02855 2E

KAWAGUCHI, M.
Influence of Accumulating Organic Sediment on the Marine Environment in Osaka Bay,
W87-03257 5C

KAWAI, Y.
Study on Chemical Behavior Between Sediment and Upper Water,
W87-03251 2J

Study on the Modelling of the Behavior of Phosphorus Released from Sediments,
W87-02967 2L

KAWAKAMI, T.
Behaviour of Intracellular Polyphosphate in the Biological Phosphate Removal Process,
W87-02735 5D

KAWASAKI, S.
Effect of Seawater on Nitrification by Attached Biofilm,
W87-02603 5D

KEEFER, R. F.
Correlation of Metal-Organic Fractions with Soil Properties in Sewage-Sludge-Amended Soils,
W87-02714 5E

KEENEY, D.
Sources of Nitrate to Ground Water,
W87-03130 5B

KEEVER, G. J.
Irrigation Scheduling Effects on Container Media and Canopy Temperatures and Growth of 'Hershey's Red' Azalea,
W87-03103 3F

KELLER, H. M.
Dissolved Loads in Streams and Rivers - Discharged and Seasonally Related Variations,
W87-03279 5B

KENNEDY, D. J. L.
Snow Loads in the 1985 National Building Code of Canada: Curved Roofs,
W87-02667 2C

KENNEDY, T. H. R.
Snow Loads in the 1985 National Building Code of Canada: Curved Roofs,
W87-02667 2C

KENT, M.
Stream Solute Sources and Variations in a Temperate Granite Drainage Basin,
W87-03296 5B

KEOWN, M. P.
Historic Trends in the Sediment Flow Regime of the Mississippi River,
W87-03195 2J

KESWICK, B. H.
Detection of Rotavirus in Treated Drinking Water,
W87-02643 5B

KETRATANAKUL, A.
Behaviour of Coliphages in Oxidation Ponds,
W87-02666 5D

KHALIL, N. A.
Salinity Tolerance of Winged Bean as Compared With That of Soybean,
W87-02988 3C

KHODAYARI, K.
Herbicides and Seeding Rate Effects on Sprinkler-Irrigated Rice,
W87-03013

KHOSLA, B. K.
Evaporation and Redistribution of Salts in a Silt Loam Soil as Affected by Tillage Induced Soil Mulch,
W87-03168 3F

KHRAPKOV, A. A.
Characteristics of the Static Performance of Dams Reservoired Hydroelectric Stations,
W87-02866 8A

KIEBER, R. J.
Two-Method Verification of Hydrogen Peroxide Determinations in Natural Waters,
W87-03050 5A

KILPATRICK, F. A.
Generalization and Applications of Tracer Dispersion Data,
W87-02620 5B

KING, K. M.
Effects of Carbon Dioxide Enrichment and Soil Water on Maize,
W87-03002 2I

KIRIKU, T.
Purification of Nho River by the Gravel Contact Method,
W87-03266 5G

KIRK, P. W. W.
Nitrilotriacetic Acid in Sludge-amended Soil: Mobility and Effects on Metal Solubility,
W87-02765 5E

KIRKBY, M. J.
Ion-Exchange Resin Samplers for the In-Site Measurement of Major Cations in Soilwater Solute Flux,
W87-02678 7B

KIRKHAM, M. B.
Problems of Using Wastewater on Vegetable Crops,
W87-02954 3C

Techniques for Water-Use Measurements of Crop Plants,
W87-02949 7B

KIRNER, J. C.
Managing an Unfiltered Water Supply,
W87-02609 5F

KLASSEN, P.
Distribute Water Effectively,
W87-02760 3F

Tips on Trickle,
W87-02761 3F

KLEIN, L.
Evaporation from the Understorey in the Jarrah (Eucalyptus Marginata Don Ex Sm.) Forest, Southwestern Australia,
W87-02679 2D

KLEMAS, V.
Biomass and Structure of a Spartina alterniflora Loisel.-dominated Salt Marsh in France,
W87-03203 2L

KLIMENT, J.
Preservation of Traces of Chromium(VI) in Water and Waste Water Samples,
W87-02804 5A

KNAPP, K. C.
Production Function for Cotton with Dated Irrigation Quantities and Qualities,
W87-03189 3F

KNEALE, W. R.
Hydrology of a Sloping, Structured Clay Soil at Wytham, Near Oxford, England,
W87-02685 2G

KNOWLTON, D. R.
Mechanism of Inactivation of Enteric Viruses in Fresh Water,
W87-02893 5B

KOBA, H.
Partial Review of Dredged Material Disposal Techniques,
W87-03259 5E

KOBAYASHI, M.
Purification of Nho River by the Gravel Contact Method,
W87-03266 5G

KOCH, K.
Virus Inactivating Effect of Anaerobic Mesophilic Digestion of Municipal Sludge With or Without Different Preceding Types of Treatment,
W87-02661 5D

KOCH, L.
Alcohol Dehydrogenase Activity in the Roots of Marsh Plants in Naturally Waterlogged Soils,
W87-02816 2I

KOCH, R. W.
Decision Support System for Local Water Management,
W87-03064 6D

KOCHKIN, N. I.
Low-Head Pumped-Storage Station as a Way of Expanding the Tsimlyansk Hydroelectric Station,
W87-03182 8C

KOCORNIK, D. J.
Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-02751 5D

KODAMA, F.
Dewatering of Bottom Sediments,
W87-03261 2J

KOE, L. C. C.
Assessment of Odorous Emissions from Sewage Pumpstations,
W87-03029 5D

KOERNER, R. M.
Designing for Flow,
W87-03125 8A

KOHLER, T.
Orthanilic Acid and Analogues as Carbon Sources for Bacteria: Growth Physiology and Enzymic Desulphonation,
W87-02781 5D

KOJIMA, I.
Prediction of the Distribution Constant of some Solutes Containing Hydrophilic Functional Groups from Data on the Solubility of Water in Organic Solvents,
W87-02906 1B

KONOVALOV, L. P.
Graphic Plotting of the Relationships of Physical Characteristics of Soils,
W87-02871 8D

KOOPMAN, B.
Seawater Induced Algal Flocculation,
W87-02703 5D

KOPEC, D. M.
Drought Avoidance in Tall Fescue,
W87-03019 2I

KOPONEN, J.
Three-dimensional Water-Quality-Transport Model Compared with Field Observations,
W87-02970 2H

KORFIATIS, G. P.
Unsaturated Flow Through Solid Waste Landfills: Model and Sensitivity Analysis,
W87-02628 5B

KORYAK, M.
Overview of Pittsburgh District Selective Withdrawal Operation Experiences,
W87-03244 5G

KOSASA, H.
Results of Sedimentation and Elutriate Tests from Osaka Bay Sediment,
W87-03258 2J

KOST, D. J.
Petroleum Recovery Operations in an Urban Area,
W87-03065 5G

KOTT, Y.
Concentration of Viruses from Water Using Pig Erythrocyte Ghost Cells,
W87-02650 5A

KOVACS, G.
Principles Underlying the Development of Water Quality Monitoring Systems in Hungary,
W87-03303 7A

KRIKELIS, V.
Detection of Indigenous Enteric Viruses in Raw Sewage Effluents of the City of Athens, Greece, during a Two Year Survey,
W87-02659 5B

KRISHNAPPAN, B. G.
Comparison of MOBED and HEC-6 River Flow Models,
W87-02669 2E

KRISTENSEN, G. H.
Exchange of Organics, Phosphate and Cations between Sludge and Water in Biological Phosphorus and Nitrogen Removal Processes,
W87-02745 5D

KRIZEK, D. T.
Methods of Inducing Water Stress in Plants,
W87-02951 2I

KROL, A. A.
Ion Exchange Properties of Retorted Rundle Oil Shale,
W87-02707 5B

KUBOI, T.
Model Simulation of Solute Leaching and Its Application for Estimating the Net Rate of Nitrate Formation under Field Conditions,
W87-02839 5B

KUCIAUSKAS, A. P.
Interim Progress Report, Volume I: SCPP Meteorological and Statistical Support for Period 1 September 1984 through 31 August 1985,
W87-03327 2B

KUKARSKII, S. G.
Experience of Using the Turbine-Generator Units of the Kolyma Hydroelectric Station for Idle Discharge of Water,
W87-03177 8C

KUMAZAWA, S.
Effect of O2 Concentration on Dark H2 Oxidation in Whole Cells of a Marine Sulfur Photosynthetic Bacterium (Chromatium sp. Strain Miami PBS 1071),
W87-03211 2L

KUNIKANE, S.
Cost Analysis of the Adverse Effects of Algal Growth in Water Bodies on Drinking Water Supply,
W87-02977 5F

KUSTOV, V. P.
Two-Chamber Consolidation Press,
W87-03183 8D

KUZ'MENKO, A. I.
Effect of the Shape of the Transition Section on Head Losses in Intakes of a Pumped-Storage Station,
W87-02867 8A

L'ESPERANCE, C.
Physiological Innocuity of Asbestos in Water,
W87-02831 5C

LAAK, R.
Wastewater Engineering Design for Unsewered Areas,
W87-03339 5E

LABOUNTY, J. F.
Primary Productivity (C14) at Twin Lakes Colorado: 1973-81 Study Results,
W87-03326 2H

LAHERMO, P.
Environmental Factors Affecting the Acid Neutralization Capacity of Finnish Glacial Till Deposits,
W87-02588 5B

LAINE, P.
Sanitary Study of Surface Water and of the Beach of a Water Sports and Leisure Complex,
W87-02777 5B

LAKSO, A. N.
Effect of Rootstock on Apple (Malus domestica) Tree Water Relations,
W87-03056 2I

LAL, R.
Effects of Tillage Methods and Water Regimes on Soil Properties and Yield of Lowland Rice from a Sandy Loam Soil in Southwest Nigeria,
W87-03164 2I

Mechanized Tillage Systems Effects on Properties of a Tropical Alfisol in Watersheds Cropped to Maize,
W87-03162 2G

Soil Water Balance of Intercropped Maize and Cowpea Grown in a Tropical Hydromorphic Soil in Western Nigeria,
W87-02989 2I

LAMBERT, G.
Anaerobic Treatment of Coke Plant Waste Water,
W87-02783 5D

LAMBERT, J. R.
Corn Irrigation Scheduling in Humid Regions on Sandy Soils with Tillage Pans,
W87-02981 3F

LAMPE, L. K.
Long Distqance Water Rights,
W87-02637 6E

LANDIS, W. G.
Toxicity of Brass Dust to the Microalgae Ankistrodesmus falcatus and Selenastrum capricornutum,
W87-02778 5C

LANGAN, T. D.
Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-03009 2I

LANGER, A. M.
Asbestos in Potable Water Supplies and Attributable Risk of Gastrointestinal Cancer,
W87-02830 5C

LAPOINTE, B. E.
Effects of Light on Growth, RuBPCase Activity and Chemical Composition of Ulva Species (Chlorophyta),
W87-02809 2L

LAPPENBUSCH, W. L.
Drinking-Water Contribution to Natural Background Radiation,
W87-03084 5F

LARSEN, I. L.
Geochemical and Environmental Processes Affecting Radionuclide Migration from a Formerly Used Seepage Trench,
W87-03135 5E

LARSEN, M.
Crater Lake, Oregon: A Restricted Basin with Base-of-Slope Aprons of Nonchannelized Turbidites,
W87-03220 2J

LASDAY, A. H.
Environmental Impact of Oil Spills and the Oil Industry Response,
W87-02829 5C

LATEGAN, P. M.
Effect of Effluent Recirculation on the Performance of a Two Stage Anaerobic Process,
W87-03088 5D

LATHAM, B.
Lessons from Field Experience with Rainwater Collection Systems in Africa and Asia,
W87-03042 5F

LAU, Y. L.
Mixing Coefficient for Ice-covered and Free-surface Flows,
W87-02671 2E

LAURO, J. F.
Analysis of Transient Phenomena in Hydroelectric Generation Plants, (Calcul des Transitoires dans les Installations Hydrauliques de Production d'Energie),
W87-02580 8C

LAVALLE, P.
Characterization of Water Using Combined Sewer Overflows, (Caracterization des Eaux Usees de Debordements de Reseau Unitaire),
W87-02672 5B

LE BAS, J.
Analysis of the Velocity Field in a Boundary Layer Generated by a Water Wave, (Analyse du Champ des Vitesses dans la Couche Limite Generee par une Onde Progressive (Houle)),
W87-02790 8B

LE FLOHIC, P.
Importance of the Acidogenic Microflora in Biological Phosphorus Removal,
W87-02749 5D

LEAHY, T. M.
Virginia, North Carolina Wage Water-Rights Battle,
W87-02638 6E

LEBEL, J.
Early Diagenesis of Cadmium and Cobalt in Sediments of the Laurentian Trough,
W87-03138 5B

LECHEVALLIER, M. W.
Bacteria Associated with Granular Activated Carbon Particles in Drinking Water,
W87-02891 5B

LEE, D. P.
Pump Station Gets Navy Discharge and New Life as Civilian,
W87-02925 5F

LEE, J. H. W.
Slack Tide Oxygen Balance Model,
W87-02889 5B

LEE, K. S.
Determination of Selective Withdrawal System Capacity for Intake Tower Design,
W87-03234 5G

LEE, S.-I.
Seawater Induced Algal Flocculation,
W87-02703 5D

LEE, S. Y.
Geochemical and Environmental Processes Affecting Radionuclide Migration from a Formerly Used Seepage Trench,
W87-03135 5E

LEENSON, S. V.
Experience in Creating Mechanical Equipment for Northern Hydroelectric Stations,
W87-03178 8C

LEHR, J. H.
Groundwater: Its Occurrence, Movement and Potential for Pollution,
W87-03309 2F

LEISINGER, T.
Orthanilic Acid and Analogues as Carbon Sources for Bacteria: Growth Physiology and Enzymic Desulphonation,
W87-02781 5D

LEMOINE, P. H.
Efficient Response Matrix Method for Coupling a Groundwater Simulator and a Regional Agricultural Management Model,
W87-02936 4B

LENNOX, W. C.
Analysis of Stochastic Groundwater Flow Problems. Part II: Stochastic Partial Differential Equations in Groundwater Flow. A Functional-Analytic Approach,
W87-02843 2F

Analysis of Stochastic Groundwater Flow Problems. Part III: Approximate Solution of Stochastic Partial Differential Equations,
W87-02844 2F

Analysis of Stochastic Groundwater Problems. Part I: Deterministic Partial Differential Equations in Groundwater Flow. A Functional-Analytic Approach,
W87-02842 2F

LERNER, H. R.
Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: I. Salinity During Growth Modulates the Proton Pump in the Halophyte Atriplex Nummularia,
W87-02717 2I

Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: II. K(+) Strongly Promotes Development of Membrane Potential in Vesicles from Cotton Roots,
W87-02718 2I

LESSARD, P.
Characterization of Water Using Combined Sewer Overflows, (Caracterization des Eaux Usees de Debordements de Reseau Unitaire),
W87-02672 5B

LESTER, J. N.
Nitrilotriacetic Acid in Sludge-amended Soil: Mobility and Effects on Metal Solubility,
W87-02765 5E

LETOLLE, R.
Overview of PCB Pollution and its Behavior in Seine River, (Apercu sur la Pollution par les P.C.B. (Polychlorobiphenyles) en Seine, et son Comportement),
W87-02564 5B

LEUZE, M.
Virus Inactivating Effect of Anaerobic Mesophilic Digestion of Municipal Sludge With or Without Different Preceding Types of Treatment,
W87-02661 5D

LEVASSEUR, J. E.
Biomass and Structure of a Spartina alterniflora Loisel.-dominated Salt Marsh in France,
W87-03203 2L

LEVIN, S. A.
Ecology and Estuarine Impact Assessment: Lessons Learned from the Hudson River (U.S.A.) and Other Estuarine Experiences,
W87-02776 2L

LEWIS, G. D.
Enterovirus Removal from Sewage: The Effectiveness of Four Different Treatment Plants,
W87-02706 5D

LI, C. T.
Starch Waste Treatment by the Activated Sludge System,
W87-02705 5D

LILLY, D. K.
Structure, Energetics and Propagation of Rotating Convective Storms. Part I: Energy Exchange with the Mean Flow,
W87-03215 2B

LIMBURG, K. E.
Ecology and Estuarine Impact Assessment: Lessons Learned from the Hudson River (U.S.A.) and Other Estuarine Experiences,
W87-02776 2L

LINDBLOM, K. C.
Designing Intakes to Avoid Free-Surface Vortices,
W87-03034 8B

LINDER, W. M.
Design and Performance of Skimming Weirs in the Kansas City District,
W87-03247 8A

LINDLEY, D.
Coastal Flood Insurance,
W87-02782 6F

LINDSAY, C. J.
Mussel Watch Program/Monitoring the Long-Term Effects of Dredged Material Disposal in New England Waters,
W87-03270 5B

LINDSTROM, F. T.
Vertical-Horizontal Transport and Fate of Low Water Solubility Chemicals in Unsaturated Soils,
W87-03074 2G

Vertical Transport and Fate of Low-Water-Solubility Chemicals in Unsaturated Soils,
W87-02836 5B

LIPPY, E. C.
Chlorination to Prevent and Control Waterborne Diseases,
W87-02613 5F

LISK, D. J.
Impact of Chemically Contaminated Sewage Sludge on the Collard Arthropod Community,
W87-03081 5C

LLOYD, J. W.
Examination of the Mechanisms Controlling Groundwater Gradients in Hyper-Arid Regional Sedimentary Basins,
W87-02942 2F

Morphology of a Saline Groundwater Body: Its Investigation, Description and Possible Explanation,
W87-02849 2F

LO, S. N.
Mixed-Culture Microbial Protein from Waste Sulfite Pulping Liquor II: Its Production on a Pilot-Plant Scale and Use in Animal Feed,
W87-03132 5E

LOCASCIO, S. J.
Nitrogen Source and Application Timing for Trickle Irrigated Strawberries,
W87-03109 3F

LODANG, D.
Data Processing for Hydro Plant Control,
W87-03033 8C

LOGSDON, G. S.
Slow Sand Filtration: Influences of Selected Process Variables,
W87-02611 5F

LONGHI, P.
Predicting Standard pH Values for Reference Buffer Solutions in Solvent Mixtures with Water,
W87-03049 5A

LONGLEY, T. S.
Changes in Spring Wheat Tillering Patterns in Response to Delayed Irrigation,
W87-03012 2I

LORDA, E.
Statistical Technique for Analysis of Environmental Data Containing Periodic Variance Components,
W87-02599 7C

LORENZO-MINGUEZ, P.
Effect of Short-term Water Stress on Leaf Gas Exchange Processes and Plant Water Potential in Schefflera,
W87-03104 2I

LOTTER, L. H.
Role of Bacterial Phosphate Metabolism in Enhanced Phosphorus Removal from the Activated Sludge Process,
W87-02743 5D

LOUTERS, T.
Algorithm for Computing the Relationship between Diffusivity and Soil Moisture Content from the Hot Air Method,
W87-02856 2G

LOUTIT, M. W.
Enterovirus Removal from Sewage: The Effectiveness of Four Different Treatment Plants,
W87-02706 5D

LOWRY, P. D.
Geochemical and Environmental Processes Affecting Radionuclide Migration from a Formerly Used Seepage Trench,
W87-03135 5E

LUDWIG, C.
Biological Phosphorus Removal in Combination with Simultaneous Precipitation,
W87-02746 5D

LUGG, D. G.
Kleingrass Yield and Quality Under Three Irrigation Regimes When Harvested at Anthesis,
W87-02993 3F

LUKIN, I. N.
Experience of Using the Turbine-Generator Units of the Kolyma Hydroelectric Station for Idle Discharge of Water,
W87-03177 8C

LUM, K. R.
Metal Concentrations in the Annual Shell Layers of the Bivalve Elliptio complanata,
W87-02764 5B

LUND, E.
Detection and Stability of Enteric Viruses in Sludge, Soil and Ground Water,
W87-02662 5B

LUND, J. R.
Drought and Power Production,
W87-03060 6D

LUTTENTON, M. R.
Effects of Disturbance on Epiphytic Community Architecture,
W87-02806 2H

LUXMOORE, R. J.
Estimating Macroporosity in a Forest Watershed by use of a Tension Infiltrometer,
W87-02917 2G

LYNN, L. M.
Vegetation of the Low-Shrub Bogs of Northern New Jersey and Adjacent New York: Ecosystems at their Southern Limit,
W87-03208 2H

MAAS, E. V.
Root Control of Leaf Phosphorus and Chlorine Accumulation in Soybean Under Salinity Stress,
W87-02984 2I

MACFARLANE, R. B.
Primary and Secondary Stress Responses of Striped Bass (Morone saxatilis) Exposed to Benzene,
W87-02771 5C

MACGREGOR, J. G.
Snow Loads in the 1985 National Building Code of Canada: Curved Roofs,
W87-02667 2C

MACHINA, D. W.
Design Factors for the Scouring of Deposited Materials in Water and Wastewater Treatment Systems,
W87-02674 5F

MACIEL, G. E.
Dissolved Organic Matter in Anoxic Pore Waters from Mangrove Lake, Bermuda,
W87-03136 5A

MACINTYRE, W. G.
Thermodynamic Study of Solutions of Liquid Hydrocarbon Mixtures in Water,
W87-03145 1B

MACKLIN, M. G.
Influence of Catastrophic Floods on Water Quality as Recorded in the Sediments of Blagdon Lake, England,
W87-03306 2H

MAEDA, S.
Bioaccumulation of Arsenic by Freshwater Algae and the Application to the Removal of Inorganic Arsenic from an Aqueous Phase: Part II. by Chlorella vulgaris Isolated from Arsenic-Polluted Environment,
W87-02907 5B

MAGARA, Y.
Cost Analysis of the Adverse Effects of Algal Growth in Water Bodies on Drinking Water Supply,
W87-02977 5F

MAGARITZ, M.
High Concentration of Solutes at the Upper Part of the Saturated Zone (Water Table) of a Deep Aquifer Under Sewage-Irrigated Land,
W87-02677 2F

MAHALAKSHMI, V.
Water Deficit During Panicle Development in Pearl Millet: Yield Compensation by Tillers,
W87-03157 2I

MAHLOCH, J. L.
Environmental and Water Quality Operational Studies (EWQOS) - Application to Lake Restoration,
W87-03271 5G

MAIDMENT, D. R.
Evaluation of Weekly and Monthly Time Series Forecasts of Municipal Water Use,
W87-02629 6A

MAJOR, J. J.
Groundwater Seepage Vectors and the Potential for Hillslope Failure and Debris Flow Mobilization,
W87-03193 2F

MAKANSKI, J.
Cogen System Fires 100% Untreated Digester Gas,
W87-03116 5D

MAKAROV, V. A.
Dimensionless Analysis of Optimum Designs,
W87-03185 8A

MALATI, M. A.
Review of the Role of Bed Deposits in the Phosphate Eutrophication of Lakes and Rivers,
W87-03022 5B

MALNOU, D.
Importance of the Acidogenic Microflora in Biological Phosphorus Removal,
W87-02749 5D

Polyphosphate Kinase Activity during Phosphate Uptake by Bacteria,
W87-02736 5D

MANSKY, J. M.
Characterization of Sediment Contamination Utilizing Bioassay/Biaccumulation Testing,
W87-03255 5B

MAPP, H. P.
Stochastic Dominance Comparison of Water-Conserving Irrigation Strategies,
W87-02873 3F

MARAIS, G. V. R.
Kinetics of Biological Phosphorus Release,
W87-02737 5D

MARCARIAN, V.
Procedure to Select Drought-Tolerant Sorghum and Millet Genotypes Using Canopy Temperature and Vapor Pressure Deficit,
W87-03001 2I

MARCHUK, A. N.
Characteristics of the Static Performance of Dams Reservoired Hydroelectric Stations,
W87-02866 8A

MARCHUK, M. A.
Characteristics of the Static Performance of Dams Reservoired Hydroelectric Stations,
W87-02866 8A

MARIVOET, J. L.
Real Time Water Quality Forecasting Models Based on the Water Quantity/Quality Relationship,
W87-03304 5A

MARKOULATOS, P.
Detection of Indigenous Enteric Viruses in Raw Sewage Effluents of the City of Athens, Greece, during a Two Year Survey,
W87-02659 5B

MARKUSSEN, J. V.
Burlington Spillway and Outlet Works Souris River, North Dakota: Hydraulic Model Investigation,
W87-03334 8B

MARKUSSEN, K. J.
Toxic Substances, Risk Management and New York State Drinking Water,
W87-02832 5B

MARTIN, C.
Chemical Erosion Measurements in the Massif des Maures: The Example of the Rimbaud Drainage Basin (Var, France)(Mesures de l'Erosion Chimique dans le Massif des Maures: l'Exemple du Basin Versant du Rimbaud (Var, France)),
W87-03294 2K

MARTIN, C. K.
Corn Irrigation Scheduling in Humid Regions on Sandy Soils with Tillage Pans,
W87-02981 3F

MARTIN, D. B.
Effects of Four Agricultural Pesticides on Daphnia pulex, Lemna minor, and Potamogeton pectinatus,
W87-02589 5C

MARTIN, F. G.
Nitrogen Source and Application Timing for Trickle Irrigated Strawberries,
W87-03109 3F

MARTINEAU, B.
Sanitary Study of Surface Water and of the Beach of a Water Sports and Leisure Complex,
W87-02777 5B

MATSCHE, N.
Biological Phosphorus Removal in Combination with Simultaneous Precipitation,
W87-02746 5D

MATSUDA, M.
Contaminating Peptides Widely Present in Ion-Exchanged Water, Reagents, Experimental Implements and Natural Sample,
W87-02787 5B

MATSUMOTO, J.
Effect of Seawater on Nitrification by Attached Biofilm,
W87-02603 5D

MATSUO, T.
Behaviour of Intracellular Polyphosphate in the Biological Phosphate Removal Process,
W87-02735 5D

MATSUOKA, T.
Environmental Conservation in the Port of Maizuru,
W87-03269 5B

MATSUOKA, Y.
Eutrophication Model of Lake Kasumigaura,
W87-02971 2H

Synthesis and Analysis of a Comprehensive Lake Model - With the Evaluation of Diversity of Ecosystems,
W87-02965 2H

MAURER, D.
Sizing Submersible Pumps,
W87-02927 8C

MAURETTE, M.
Placers of Cosmic Dust in the Blue Ice Lakes of Greenland,
W87-02913 2C

MAYNORD, S. T.
Riprap Stability and Navigation Tests for the Divide-Cut Section Tennessee-Tombigbee Waterway,
W87-03317 8A

MAZOR, E.
Tritium Corrected 14C and Atmospheric Noble Gas Corrected 4He Applied to Deduce Ages of Mixed Groundwaters: Examples from the Baden Region, Switzerland,
W87-03147 5A

MAZURENKO, L. V.
Restoration of Pipe Drainage in Foundations of Hydraulic Structures on Carbonate Rocks,
W87-03184 8A

MCCARTHY, J. F.
Anomalous Binding of Organic Contaminants May Be Artifactual Due to Radiochemical Impurities,
W87-02700 5A

MCDONNELL, A. J.
Macrophyte Growth in Shallow Streams: Biomass Model,
W87-02888 5C

Macrophyte Growth in Shallow Streams: Field Investigations,
W87-02887 5C

MCDONNELL, E.
Salt Tolerance in the Triticeae: Salinity-Induced Changes in the Leaf Solute Composition of Some Perennial Triticeae,
W87-02785 2I

MCFETERS, G. A.
Bacteria Associated with Granular Activated Carbon Particles in Drinking Water,
W87-02891 5B

MCINTIRE, C. D.
Effects of Current Velocity and Light Energy on the Structure of Periphyton Assemblages in Laboratory Streams,
W87-02808 2H

MCINTOSH, A.
Distribution of Benthic Macroinvertebrates in a Stream Exposed to Urban Runoff,
W87-02939 5C

MCMANUS, J.
Variation in Solute Concentration Within the River Almond and Its Effect on the Estimated Dissolved Load,
W87-03274 5B

MCTERNAN, W. F.
Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-02751 5D

MEDLEN, A. R.
Electrofocusing of Viruses and Sensitivity to Disinfection,
W87-02664 5D

MEDVEDEV, L. G.
Analysis of Methods of Determining the Compressive Strength of Rocks,
W87-03180 8E

MEGANCK, M.
Importance of the Acidogenic Microflora in Biological Phosphorus Removal,
W87-02749 5D

MEIER, J.
Large Pelton Turbines for Canada's Cat Arm Scheme,
W87-02688 8C

MEIN, R. G.
Determination of Rainfall Excess on Spatially Variable Catchments,
W87-02853 2A

MEIRI, A.
Irrigation Interval as a Factor in Sweet Corn Response to Salinity,
W87-03003 3C

MELNICK, J. L.
Development of a Method for Concentration of Rotavirus and Its Application to Recovery of Rotaviruses from Estuarine Waters,
W87-02896 5A

Human Viruses in Sediments, Sludges, and Soils,
W87-02768 5B

MELVIN, S. W.
Alternatives to the Use of Agricultural Drainage Wells,
W87-02624 4B

MENON, A. S.
Salmonellae and Pollution Indicator Bacteria in Municipal and Food Processing Effluents and the Cornwallis River,
W87-02815 5D

METCALF, T. G.
Development of a Method for Concentration of Rotavirus and Its Application to Recovery of Rotaviruses from Estuarine Waters,
W87-02896 5A

Human Viruses in Sediments, Sludges, and Soils,
W87-02768 5B

METCALFE, W. S.
Survivorship and Spatial Development of Spartina alterniflora Loisel. (Gramineae) Seedlings in a New England Salt Marsh,
W87-03096 2L

MEYBECK, M.
Atmospheric Inputs and River Transport of Dissolved Substances,
W87-03287 2B

MEYER, A. W.
Crater Lake, Oregon: A Restricted Basin with Base-of-Slope Aprons of Nonchannelized Turbidites,
W87-03220 2J

MEYER, M.
Structuring of Ecological Data Sets by Methods of Correlation and Cluster Analysis,
W87-02597 2L

MHAISALKAR, V. A.
Innovative Technique for Determining Velocity Gradient in Coagulation--Flocculation Process,
W87-02708 5F

MICHEL, J.
Drinking-Water Contribution to Natural Background Radiation,
W87-03084 5F

MICHLER, G.
Heavy Metal Content in Sediments of Lakes in Southern Bavaria as a Sign of Long-Term Environmental Impact,
W87-03305 5C

MIELKE, L. N.
Physical Environment Near the Surface of Plowed and No-Tilled Soils,
W87-03171 2G

MIKASA, H.
Fluorometric Determination of Nitrite in Natural Waters with 3-Aminonaphthalene-1,5-disulphonic Acid by Flow-Injection Analysis,
W87-03172 5A

MIKHAILOV, I. E.
Effect of the Shape of the Transition Section on Head Losses in Intakes of a Pumped-Storage Station,
W87-02867 8A

MILES, J. C.
Examination of the Mechanisms Controlling Groundwater Gradients in Hyper-Arid Regional Sedimentary Basins,
W87-02942 2F

MILLER, B.
Stemming the Loss of Coastal Wetland Habitats: Jamaica as a Model for Tropical Developing Countries,
W87-03128 2L

MILLER, D. E.
Responses of Sugarbeet to Deficit, High-Frequency Sprinkler Irrigation. I. Sucrose Accumulation, and Top and Root Dry Matter Production,
W87-02985 3F

Responses of Sugarbeet to Deficit, High-Frequency Sprinkler Irrigation. II. Sugarbeet Development and Partitioning to Root Growth,
W87-02986 3F

Root Systems in Relation to Stress Tolerance,
W87-02961 2I

Yield and Physiological Responses of Potatoes to Deficit, High Frequency Sprinkler Irrigation,
W87-02997 3F

MILLER, J. C.
Rate of Water Loss from Detached Leaves of Drought Resistant and Susceptible Genotypes of Cowpea,
W87-02960 2I

MILLER, R. L.
Effects of Temperature, Salinity, Irradiance and Diurnal Periodicity on Growth and Photosynthesis in the Diatom Nitzschia americana: Light-Saturated Growth,
W87-02807 2L

MINHAS, P. S.
Evaporation and Redistribution of Salts in a Silt Loam Soil as Affected by Tillage Induced Soil Mulch,
W87-03168 3F

MINNIGH, H.
Fungi in Potable Water Distribution Systems,
W87-02614 5B

MINNIGH, H. A.
Comparison of Clark's Presence-Absence Test and the Membrane Filter Method for Coliform Detection in Potable Water Samples,
W87-02892 5A

MINO, T.
Behaviour of Intracellular Polyphosphate in the Biological Phosphate Removal Process,
W87-02735 5D

MITCHELL, A. R.
Polyacrylamide Application in Irrigation Water to Increase Infiltration,
W87-02911 2G

MITSUI, A.
Effect of O2 Concentration on Dark H2 Oxidation in Whole Cells of a Marine Sulfur Photosynthetic Bacterium (Chromatium sp. Strain Miami PBS 1071),
W87-03211 2L

MIURA, J.
Selective Preconcentration of Copper from Aqueous Solution by Using Kerateine Gel,
W87-02802 5A

MIYAJI, Y.
Factors Affecting Biological Removal of Phosphorus,
W87-02748 5D

MIYAKE, M.
Partial Review of Dredged Material Disposal Techniques,
W87-03259 5E

MIYAKOSHI, A.
Modelling of the Lower Trophic Levels of a Marine Ecosystem and Its Example of Short-period Variations of Chlorophyll and Nutrient in Harima-Nada,
W87-02601 2L

MIYAMOTO, S.
Spatial Variability and Soil Sampling for Salinity and Sodicity Appraisal in Surface Irrigated Orchards,
W87-02726 2G

MIYANAGA, Y.
Modelling of Stratified Flow and Eutrophication in Reservoirs,
W87-02968 5C

MOHAMMAD, W. A.
Improved Monitoring of Air in Water,
W87-03038 7B

MOKHTAR, M. B.
Speciation of Manganese in Freshwaters,
W87-03051 2K

MOKSNES, M. T,
Levels of Chlorinated Hydrocarbons and Composition of PCB in Herring Gull Larus argentatus Eggs Collected in Norway in 1969 Compared to 1979-81,
W87-02585 5B

MOLLENHAUER, K.
Runoff Processes and Dissolved Substances During Flood Events in Small Differently Used Drainage Areas,
W87-03283 2E

MOLLER, D.
Composition of Precipitation Water and Its Acidity,
W87-02721 5B

MOLZ, F. J.
Deterministic and Stochastic Analyses of Dispersion in an Unbounded Stratified Porous Medium,
W87-03196 5B

MONITION, L.
Small Hydroelectric Plants and Environemental Protection, (Petite Hydraulique et Protection de l'Environment),
W87-02573 8C

MONK, C. D.
Rates of Mineral Element Leaching from Leaves of Nine Plant Species from a Southern Appalachian Forest Succession Subjected to Simulated Acid Rain,
W87-03206 5C

MONTORO, R.
Flame Absorption Spectroscopic Determination of Cadmium, Copper, Iron, Lead, and Zinc in Mussels,
W87-03115 5A

MOODIE, J. W.
Genomic Analysis of RNA Viruses Isolated from Water,
W87-02645 5A

MOORE, I. D.
Kinematic Overland Flow: Generalization of Rose's Approximate Solution,
W87-02841 2E

Preferential Flow and Hydraulic Conductivity of Forest Soils,
W87-02724 2G

MOREAU, D. H.
Financial Planning Model and Its Application,
W87-03058 6B

MOREAU, J. R.
Mixed-Culture Microbial Protein from Waste Sulfite Pulping Liquor II: Its Production on a Pilot-Plant Scale and Use in Animal Feed,
W87-03132 5E

MOREHEAD, M.
Alternatives for Improving Reservoir Water Quality,
W87-03228 5G

MORIOKA, T.
Analysis and Cartographical Approach to the Regional Water Utilization System in the Yodo River Basin,
W87-02978 6D

Basin-wide Ecological Fate Model for Management of Chemicals Hazard,
W87-02975 5B

MORRILL, L. G.
Influence of Soil Structure on Movement Rate of Salts Through Soils,
W87-02716 5B

MORRIS, R.
Detection of Enteroviruses: An Assessment of Ten Cell Lines,
W87-02651 5A

Failure to Detect Cytopathic Enteroviruses in Drinking Water,
W87-02654 5A

MOTOKI, T.
65 MW Bulb Turbine for Japan's Tadami Project,
W87-02691 8C

MOTOMIZU, S.
Fluorometric Determination of Nitrite in Natural Waters with 3-Aminonaphthalene-1,5-disulphonic Acid by Flow-Injection Analysis,
W87-03172 5A

MOUSER, K. F.
Indiana Waste Days Beyond Expectations,
W87-02757 5G

MOY, R. L.
Pump Station's Cost Reduced Dramatically,
W87-03121 5D

MOYER, B.
Comparison of Clark's Presence-Absence Test and the Membrane Filter Method for Coliform Detection in Potable Water Samples,
W87-02892 5A

MOYLE, P. B.
Patterns in Distribution and Abundance of a Noncoevolved Assemblage of Estuarine Fishes in California,
W87-02758 2L

MUCHEIK, M.
Soil Application of a Hydrophilic Conditioner in Relation to Moisture, Irrigation Frequency and Crop Growth,
W87-02881 3F

MUCHNICKI, D.
Current State of Ohio's Water Law from a Judicial and Administrative Perspective: Case Studies and Discussion,
W87-03314 6E

MUFTUGIL, N.
Determination of Pollution and Eutrophic Conditions of Sapanca Lake (Turkey),
W87-02587 5B

MUNIR, J.
Regime of Ground Water of Semberian Aquifer,
W87-03043 2F

MURAKAMI, A.
Chromatic Regulation of Photosystem Composition in the Photosynthetic System of Red and Blue-Green Algae,
W87-03212 2H

MURAOKA, K.
Box Model for Prediction of Water Quality in Eutrophic Lakes,
W87-02972 2H

MURPHY, C. L.
Finite-Element Collocation Method for Variably Saturated Flow in Two Space Dimensions,
W87-03192 2F

MURPHY, E. F.
Ohio Water Law: Analyses of Present Water Protection Strategies and Suggestions for the Future,
W87-03311 6E

MUSE, W. T.
Toxicity of Brass Dust to the Microalgae Ankistrodesmus falcatus and Selenastrum capricornutum,
W87-02778 5C

MUSSINI, T.
Predicting Standard pH Values for Reference Buffer Solutions in Solvent Mixtures with Water,
W87-03049 5A

NAGPAL, N. K.
Effect of Soil and Effluent Characteristics on Phosphorus Sorption in Dosed Columns,
W87-02861 2G

NAITO, M.
Eutrophication Model of Lake Kasumigaura,
W87-02971 2H

NAKAMURA, Y.
Selective Preconcentration of Copper from Aqueous Solution by Using Kerateine Gel,
W87-02802 5A

NAKANISHI, H.
Study on Chemical Behavior Between Sediment and Upper Water,
W87-03251 2J

Study on the Modelling of the Behavior of Phosphorus Released from Sediments,
W87-02967 2L

NAKASHIMA, S.
Bioaccumulation of Arsenic by Freshwater Algae and the Application to the Removal of Inorganic Arsenic from an Aqueous Phase: Part II. by Chlorella vulgaris Isolated from Arsenic-Polluted Environment,
W87-02907 5B

NATORI, M.
Results of Sedimentation and Elutriate Tests from Osaka Bay Sediment,
W87-03258 2J

NAWY, E. G.
Unsaturated Flow Through Solid Waste Landfills: Model and Sensitivity Analysis,
W87-02628 5B

NEAL, C.
Modelling the Effects of Acidic Deposition And Conifer Afforestation on Stream Acidity in the British Uplands,
W87-03068 5C

Modelling the Effects of Hydrological Changes on Stream Water Acidity,
W87-02684 2E

NEALA, R.
Modelling the Effects of Acidic Deposition And Conifer Afforestation on Stream Acidity in the British Uplands,
W87-03068 5C

NEALE, R.
Modelling the Effects of Hydrological Changes on Stream Water Acidity,
W87-02684 2E

Preliminary Model of Long-Term Changes in Stream Acidity in Southwestern Scotland,
W87-02682 5G

NEDRIGA, V. P.
Construction of Dams on Soils Containing Soluble Salts,
W87-03186 8E

NEEMAN, Y.
Concentration of Viruses from Water Using Pig Erythrocyte Ghost Cells,
W87-02650 5A

NEILSEN, G. H.
Effect of Woven Plastic Mulch, Herbicides, Grass Sod, and Nitrogen on 'Foch' Grapes Under Irrigation,
W87-03106 3F

Effects of Frequency of Irrigation on Nutrient Uptake of Apple Trees,
W87-02875 3F

NELSON, C. H.
Crater Lake, Oregon: A Restricted Basin with Base-of-Slope Aprons of Nonchannelized Turbidites,
W87-03220 2J

NELSON, J. G.
Wildland Management on Point Pelee, Rondeau, and Long Point Peninsulas, Lake Erie,
W87-02591 6G

NEUFELD, R. J.
Avoidance-Preference Reactions of Rainbow Trout (Salmo Gairdneri) After Prolonged Exposure to Chromium(VI),
W87-02698 5C

NICHOLAICHUK, W.
Snow and Fertilizer Management for Continuous Zero-Till Spring Wheat,
W87-02879 3F

NICHOLLS, H. A.
Readily Biodegradable Fraction of Sewage: Its Influence on Phosphorus Removal and Measurement,
W87-02738 5D

NIEBER, J. L.
Drains as a Boundary Condition in Finite Elements,
W87-03201 2F

NIEMIEC, A.
Analytical and Numerical Solution of Saint-Venant Equations,
W87-03067 2E

NIKAIDO, K.
Results of Sedimentation and Elutriate Tests from Osaka Bay Sediment,
W87-03258 2J

NIKONOROV, V. P.
Pakem Hydro Development on the Pakem River,
W87-02870 8A

NISHIDA, N.
Interactive Algorithm for the Parameter Estimation of Complex Systems and Its Application to an Ecological Modelling of an Actual Japanese Lake,
W87-02600 2H

NIWAS, S.
Aquifer Transmissivity of Porous Media from Resistivity Data,
W87-02837 7B

NOGUCHI, H.
Influence of Accumulating Organic Sediment on the Marine Environment in Osaka Bay,
W87-03257 5C

NOLAN, B. T.
Polymer Flotation and Activated Carbon Adsorption Treatment for In Situ Tar Sand Process Water,
W87-02751 5D

NOLAN, R. P.
Asbestos in Potable Water Supplies and Attributable Risk of Gastrointestinal Cancer,
W87-02830 5C

NOLLER, B. N.
Nutrient and Trace Metal Fluxes in the Magela Creek System, Northern Australia,
W87-02974 2E

NORHEIM, G.
Levels of Chlorinated Hydrocarbons and Composition of PCB in Herring Gull Larus argentatus Eggs Collected in Norway in 1969 Compared to 1979-81,
W87-02585 5B

NORO, K.
Modelling of Industrial Ecological Systems for Evaluation of Health Services,
W87-02979 4C

NORRIS, L B.
Relationships Between Growth and Measured Weather Factors Among Contrasting Varieties of Lolium, Dactylis and Festuca Species,
W87-03100 2I

NOVAK, J. T.
Biodegradation of Methanol and Tertiary Butyl Alcohol in Subsurface Systems,
W87-02732 5B

NUPEN, E. M.
Recovery of Viruses from Drinking-Water by Means of an In-Line Electropositive Cartridge Filter,
W87-02649 5A

NURNBERG, H. W.
Trace Determination of Chromium in Various Water Types by Adsorption Differential Pulse Voltammetry,
W87-02797 5A

NUS, J. L.
Differential Sensitivity of Turfgrass Organs to Water Stress,
W87-02962 2I

O'BRIEN, J. H.
Biodegradation of Methanol and Tertiary Butyl Alcohol in Subsurface Systems,
W87-02732 5B

O'DELL, C. R.
Lock and Dam 1, Red River Waterway: Hydraulic Model Investigation,
W87-03333 8B

OBERG, K. A.
Effect of Rainfall Excess Calculations on Modeled Hydrograph Accuracy and Unit-Hydrograph Parameters,
W87-02623 2B

OBERTS, G. L.
Pollutants Associated with Sand and Salt Applied to Roads in Minnesota,
W87-02943 5B

OCHSENKUHN-PETROPULU, M.
Investigations on the Application of the Ion-Exchanger SRAFION NMRR for the Enrichment and Separation of Uranium and Other Trace Elements from Sea Water, (Untersuchungen uber die Verwendbarkeit des Ionenaustauschers SRAFION NMRR zur Anreicherung und Abtrennung von Uran und anderen Spurenelementen aus dem Meerwasser),
W87-02803 5A

ODDIE, K. M.
R-Plasmid Transfer in Soil and Water,
W87-02792 5C

OGAWA, H.
Modelling of Industrial Ecological Systems for Evaluation of Health Services,
W87-02979 4C

OGAWA, T.
Effect of O2 Concentration on Dark H2 Oxidation in Whole Cells of a Marine Sulfur Photosynthetic Bacterium (Chromatium sp. Strain Miami PBS 1071),
W87-03211 2L

OGLESBEE, S. E.
Detection of Hepatitis A Virus (HAV) in Drinking Water,
W87-02646 5A

OGUNREMI, L. T.
Effects of Tillage Methods and Water Regimes on Soil Properties and Yield of Lowland Rice from a Sandy Loam Soil in Southwest Nigeria,
W87-03164 2I

OHKI, K.
Chromatic Regulation of Photosystem Composition in the Photosynthetic System of Red and Blue-Green Algae,
W87-03212 2H

OHUCHI, A.
Modelling of the Lower Trophic Levels of a Marine Ecosystem and Its Example of Short-period Variations of Chlorophyll and Nutrient in Harima-Nada,
W87-02601 2L

OKADA, M.
Model of Nitrogen Release from Bottom Sediments,
W87-03250 5B

Study of Dissolved Oxygen Budgets in Natural and Artificial Lakes,
W87-02976 2H

OKAJIMA, H.
Dewatering of Bottom Sediments,
W87-03261 2J

OKINO, T.
Interactive Algorithm for the Parameter Estimation of Complex Systems and Its Application to an Ecological Modelling of an Actual Japanese Lake,
W87-02600 2H

OLIEN, W. C.
Effect of Rootstock on Apple (Malus domestica) Tree Water Relations,
W87-03056 2I

OLSEN, C. R.
Geochemical and Environmental Processes Affecting Radionuclide Migration from a Formerly Used Seepage Trench,
W87-03135 5E

OMURA, T.
Behaviour of Coliphages in Oxidation Ponds,
W87-02666 5D

OPLINGER, E. S.
Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-03009 2I

OREM, W. H.
Dissolved Organic Matter in Anoxic Pore Waters from Mangrove Lake, Bermuda,
W87-03136 5A

ORON, G.
Trickle Irrigation of Wheat Applying Renovated Wastewater,
W87-02938 3F

ORSBORN, J. F.
Review and Analysis of Methods for Quantifying Instream Flow Requirements,
W87-02933 6D

Stream Improvements and Fish Response: A Bio-engineering Assessment,
W87-02932 4A

OSBORN, D. W.
Readily Biodegradable Fraction of Sewage: Its Influence on Phosphorus Removal and Measurement,
W87-02738 5D

OSTENDORF, D. W.
Hydraulics of Rectangular Clarifiers,
W87-02886 8B

OSWALT, N. R.
Burlington Spillway and Outlet Works Souris River, North Dakota: Hydraulic Model Investigation,
W87-03334 8B

Riprap Stability and Navigation Tests for the Divide-Cut Section Tennessee-Tombigbee Waterway,
W87-03317 8A

OTOMA, S.
Model Simulation of Solute Leaching and Its Application for Estimating the Net Rate of Nitrate Formation under Field Conditions,
W87-02839 5B

OTTAWAY, E. M.
Nutrient and Trace Metal Fluxes in the Magela Creek System, Northern Australia,
W87-02974 2E

OWEN, W. F.
Fundamentals of Anaerobic Digestion of Wastewater Sludges,
W87-02884 5D

OYEGUN, R. O.
Financial Viability and Economic Efficiency of Water Supply in Kwara State - The Case of Ilorin,
W87-03046 5F

PAKHOMOV, O. A.
Effective Technology of Constructing Earth Structures,
W87-02864 8A

Method of Investigating the Compactibility of Cohesive Soils,
W87-02865 8D

PALMER, R. N.
Complexity in Columbia River Systems Modeling,
W87-03059 6B

Drought and Power Production,
W87-03060 6D

PAPADOPOULOS, F.
Mathematical Prediction of Thermal Stratification of Lake Ostrovo (Vegoritis), Greece,
W87-03198 2H

PAPADOPOULOS, I.
Effect of High Sulfate Irrigation Waters on Soil Salinity and Yields,
W87-02996 3C

PAPCHENKOV, V. G.
Classification of Macrophytes in Bodies of Water and of Aquatic Vegetation,
W87-02772 2H

PAPENDICK, R. I.
Estimating Generalized Soil-water Characteristics from Texture,
W87-02727 2G

PARAMASIVAM, R.
Innovative Technique for Determining Velocity Gradient in Coagulation--Flocculation Process,
W87-02708 5F

PARHAD, N. M.
Growth of Salmonellas in Different Enrichment Media,
W87-02786 5A

PARISH, W.
Petroleum Recovery Operations in an Urban Area,
W87-03065 5G

PARISSAKIS, G.
Investigations on the Application of the Ion-Exchanger SRAFION NMRR for the Enrichment and Separation of Uranium and Other Trace Elements from Sea Water, (Untersuchungen uber die Verwendbarkeit des Ionenaustauschers SRAFION NMRR zur Anreicherung und Abtrennung von Uran und anderen Spurenelementen aus dem Meerwasser),
W87-02803 5A

PARK, J. K.
Modeling of Pollutant Dispersion in Stratified Oscillatory Flows,
W87-02885 5B

PARKER, P. A.
Fishing from the Bank: Public Recreational Rights along Idaho's Rivers and Lakes,
W87-02594 6E

PARKIN, G. F.
Fundamentals of Anaerobic Digestion of Wastewater Sludges,
W87-02884 5D

PARLANGE, J. -Y.
Comparison of Steady Infiltration Solutions for Spherical Cavities Under Simple Versus Variable Hydraulic Properties,
W87-02712 2G

PASSARELLI, R. E.
Possible Role of Symmetric Instability in the Formation of Precipitation Bands,
W87-03213 2B

PATIL, M. D.
Growth of Salmonellas in Different Enrichment Media,
W87-02786 5A

PATTERSON, R. J.
Retardation of Toxic Chemicals in a Contaminated Outwash Aquifer,
W87-02731 5B

PAULY, E. G.
Acyclic Archaebacterial Ether Lipids in Swamp Sediments,
W87-03141 5A

PAVCHICH, M. P.
Effective Technology of Constructing Earth Structures,
W87-02864 8A

PAVEL, J.
Preservation of Traces of Chromium(VI) in Water and Waste Water Samples,
W87-02804 5A

PAYMENT, P.
Detection and Health Risk Associated with Low Virus Concentration in Drinking Water,
W87-02653 5A

PEACOCK, C. D.
Characterization and Classification of Seaside-Salt-marsh Soils on Virginia's Eastern Shore,
W87-02919 2L

PEARSON, C. H.
Irrigation Effects on Agronomic Characters of Meadowfoam,
W87-02995 3F

PEDERSEN, T.
Vertical Diffusion in Meromictic Powell Lake, British Columbia,
W87-02780 2H

PEIRCE, J. J.
Termination Criteria for Clay Permeability Testing,
W87-02788 2G

PELLIZZARI, E.
Concentrations of 20 Volatile Organic Compounds in the Air and Drinking Water of 350 Residents of New Jersey Compared with Concentrations in Their Exhaled Breath,
W87-02774 5B

PENDLETON, J. W.
Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-03009 2I

PENNINGTON, J. C.
Feasibility of Using Mycorrhizal Fungi for Enhancement of Plant Establishment on Dredged Material Disposal Sites: A Literature Review,
W87-03316 3D

PENNINGTON, M. G.
Antidegradation Policy for Preserving Surface Water Quality in Florida,
W87-02636 5G

PERRY, K.
Vertical Diffusion in Meromictic Powell Lake, British Columbia,
W87-02780 2H

PERRY, R.
Nitrilotriacetic Acid in Sludge-amended Soil: Mobility and Effects on Metal Solubility,
W87-02765 5E

PESCOD, M. B.
Water Supply in Developing Countries: Improving on Current Practice,
W87-02784 5G

PESSARAKLI, M.
Ammonium (15N) Metabolism in Cotton Under Salt Stress,
W87-03151 5C

PETERSEN, G. W.
Soil Potential Ratings for Onsite Wastewater Disposal,
W87-02860 5E

PETERSON, C. M.
Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-03010 2I

PETERSON, D. L.
Watershed Modeling for Fire Management Planning in the Northern Rocky Mountains,
W87-03323 4D

PETERSON, M. L.
Arsenic Distributions in Porewaters and Sediments of Puget Sound, Lake Washington, the Washington Coast and Saanich Inlet, B.C.,
W87-03133 5B

PETTIBONE, G. W.
Effect of Organotins on Fecal Pollution Indicator Organisms,
W87-02901 5C

PETTS, G. E.
Wave Movement and Water-Quality Variations During a Controlled Release from Kielder Reservoir, North Tyne River, U. K.,
W87-02681 2E

PFANNHAUSER, W.
Determination of Halogenated Solvent Residues in Water, Waste Water, Feeding-Stuffs, and Food, (Bestimmung halogenierter Losungsmittelruckstande in Wasser, Abwasser, Futter- und Lebensmitteln),
W87-03086 5A

PFLEEGER, T. G.
Environmental Gradients in Northwest Freshwater Wetlands,
W87-02615 2H

PICOLLIER, G.
Economy and Performance of Small Turbines, (Economie et Performance des Petites Turbines),
W87-02570 8C

PIMENTEL, D.
Impact of Chemically Contaminated Sewage Sludge on the Collard Arthropod Community,
W87-03081 5C

PIMKIN, A. V.
Comparison of Various Methods of Controlling the Long-Term Operating Regimes of Hydroelectric Stations,
W87-03176 8C

PINEAU, M.
Estimation of Wastewater Treatment Costs: Evaluation of the CAPDET Model for Canadian Conditions,
W87-02670 5D

PINTER, G.
Principles Underlying the Development of Water Quality Monitoring Systems in Hungary,
W87-03303 7A

PIPES, W. O.
Comparison of Clark's Presence-Absence Test and the Membrane Filter Method for Coliform Detection in Potable Water Samples,
W87-02892 5A

Fungi in Potable Water Distribution Systems,
W87-02614 5B

PIRBAZARI, M.
Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial Wastewater Reuse and Priority Pollutant Removal,
W87-02753 5D

PISCITELLI, V.
Phenotypic Characteristics of Coliform and Noncoliform Bacteria from a Public Water Supply Compared with Regional and National Clinical Species,
W87-02894 5A

PISIGAN, R. A.
Effects of Water Quality Parameters on the Corrosion of Galvanized Steel,
W87-02608 5G

PITMAN, A. R.
Readily Biodegradable Fraction of Sewage: Its Influence on Phosphorus Removal and Measurement,
W87-02738 5D

PIVER, W. T.
Vertical-Horizontal Transport and Fate of Low Water Solubility Chemicals in Unsaturated Soils,
W87-03074 2G

Vertical Transport and Fate of Low-Water-Solubility Chemicals in Unsaturated Soils,
W87-02836 5B

PLANCHARD, J.
Analysis of Transient Phenomena in Hydroelectric Generation Plants, (Calcul des Transitoires dans les Installations Hydrauliques de Production d'Energie),
W87-02580 8C

PLATTS, W. S.
Morphological Features of Small Streams: Significance and Function,
W87-02931 4A

PLUGE, W.
Fertilizers Suitable for the Environment as Part of a Reorientation in Agricultural Policy,
W87-03040 5G

POLLEY, R. D.
Prevention and Treatment of Endemic Iodine-Deficiency Goiter by Iodination of a Municipal Water Supply,
W87-02779 5F

POPESCU, M.
Computation of Hydraulic Transients in Complex Hydro Schemes,
W87-03036 8A

PORRO, I.
Response of Corn to Tillage and Delayed Irrigation,
W87-03007 2I

PORTNOY, J. W.
Impacts from Mosquito Control-Induced Sulphur Mobilization in a Cape Cod Estuary,
W87-03127 5C

POTTS, D. F.
Watershed Modeling for Fire Management Planning in the Northern Rocky Mountains,
W87-03323 4D

POWLESLAND, C.
Acute and Chronic Toxicity of Nickel to Larvae of Chironomus riparis (Meigen),
W87-03083 5C

PRAIRIE, Y. T.
Effect of Catchment Size on Phosphorus Export,
W87-02941 5B

PRASAD, J.
Compection and Tillage Depth Combinations for Water Management and Rice Production in Low-Retentive Permeable Soils,
W87-03163 3F

PRASAD, S. S.
Forms of Nitrogen in Waterlogged Soils and Their Contribution to Yield and Nitrogen Uptake by Rice,
W87-03158 3C

PRAT, M.
Numerical Simulation Relating Land Uses Within a Drainage Basin to the Downstream River Water Quality (Simulation Numerique de l'Influence des Pratiques Culturales dans un BAsin Versant sur la Qualite des Eaux a Son Exutoire),
W87-03300 6G

PRATTS, J. D.
Wave Movement and Water-Quality Variations During a Controlled Release from Kielder Reservoir, North Tyne River, U. K.,
W87-02681 2E

PRATURI, A.
Experiments on Vertical Plane Buoyant Jets in Shallow Water,
W87-02762 8B

PRICE, J. F.
Interactive Effects of Trickle Irrigation Rates, Cultivars, and Culture on Cut Chrysanthemum,
W87-02959 3F

PRICE, R. E.
Selective Withdrawal Needs for Lake Greeson Arkansas Intake Structure,
W87-03242 5G

PRIDDLE, M.
Retardation of Toxic Chemicals in a Contaminated Outwash Aquifer,
W87-02731 5B

PRIHAR, S. S.
Evaporation and Redistribution of Salts in a Silt Loam Soil as Affected by Tillage Induced Soil Mulch,
W87-03168 3F

PRUNTY, L.
Soil-Water Determination Using Fiber Optics,
W87-02723 2G

PUNNETT, R. E.
Selective Experiences: Alias Withdrawal Pains,
W87-03246 6B

PURCHASE, N. G.
Chione (Austrovenus) stutchburyi, a New Zealand Cockle, as a Bio-indicator for Lead Pollution,
W87-02586 5A

QI, W.-B.
Spectrophotometric Determination of Chromium in Waste Water and Soil,
W87-03052 5A

QUINN, B.
Cost of Pure Water,
W87-02642 5G

When Snow Falls in a Small Town,
W87-02640 2C

RABAUD, J.
Few Data about Independent Producers of Hydroelectricity in France, (Quelques Donnees sur la Production Hydroelectrique Autonome en France),
W87-02567 8C

RACHLIN, J. W.
Test of a Proposed Organizational Framework for the Ordering of Algal Toxicity Responses,
W87-03205 5C

RACHWAL, A. J.
Biological Phosphorus and Nitrogen Removal at an Experimental Full Scale Plant in the U.K.,
W87-02750 5D

RADA, R. G.
Effects of Disturbance on Epiphytic Community Architecture,
W87-02806 2H

RADIN, J. W.
Accumulation and Turnover of Abscisic Acid in Osmotically Stressed Cotton Leaf Tissue in Relation to Temperature,
W87-03216 2I

RAESE, J. T.
Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. I. Soil Moisture, Water Relations, Tree and Fruit Growth,
W87-03110 3F

RAJENDRAN, R.
Determination of Rainfall Excess on Spatially Variable Catchments,
W87-02853 2A

RAMAKRISHNA, K.
Emergence of Environmental Law in the Developing Countries: A Case Study of India,
W87-02616 6E

RAMUS, J.
Effects of Light on Growth, RuBPCase Activity and Chemical Composition of Ulva Species (Chlorophyta),
W87-02809 2L

RANDO, A. J.
Pump Station's Cost Reduced Dramatically,
W87-03121 5D

RANKIN, A. G.
Supplemental Class III Archaeological Survey of the Phase A, Reach 3 Corridor, Tucson Aqueduct, Central Arizona Project: Late Sedentary and Early Classic Period Tucson Basin Hohokam Occupation in the Lower Santa Cruz Basin, Marana to Rillito, Arizona,
W87-03329 6G

RAO, S. V. R.
Effect of Metal Chelation on the Toxicity of Some Environmentally Hazardous Trace Metals to Daphnia magna,
W87-03024 5G

RAO, V. C.
Development of a Method for Concentration of Rotavirus and Its Application to Recovery of Rotaviruses from Estuarine Waters,
W87-02896 5A

Human Viruses in Sediments, Sludges, and Soils,
W87-02768 5B

RAPER, C.
Amoco Cadiz and Limitation of Liability for Oil Spill Pollution: Domestic and International Solutions,
W87-02593 6E

RAPHAEL, R. A.
Rotavirus Survival in Raw and Treated Waters and Its Health Implications,
W87-02644 5G

RASE, J. T.
Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. II. Mineral Composition of Fruit and Leaves, Fruit Disorders, and Fruit Set,
W87-03111 3F

RAUCH, H. W.
Anomalous Natural Sulfate in Water Wells of the Greenbrier Group, West Virginia,
W87-02625 5B

RAVESLOOT, J. C.
Research Design for Tucson Aqueduct, Phase B Data Recovery,
W87-03328 6G

RAWLS, W. J.
Estimating Generalized Soil-water Characteristics from Texture,
W87-02727 2G

RAZACK, M.
Evolution in Space and Time of an Alluvial Aquifer under the Effect of an Exceptional Multi-Year Drought (Mediterranean Shore, Herault, France) (Evolution Spatio-Temporelle d'un Aquifere Alluvial sous l'Effet d'une Secheresse Pluriannuelle Exceptionnelle (Littoral Mediterraneen, Herault, France)),
W87-02838 2F

REDREEV, A. E.
Experiencein the Manufacture and Installation of the Reinforced Concrete-Encased Steel Pipelines of the Zagorsk Pumped-Storage Station,
W87-02869 8A

REEH, N.
Placers of Cosmic Dust in the Blue Ice Lakes of Greenland,
W87-02913 2C

REESE, J. R.
Selection and Management of a New Orlean Dredged Material Disposal Site at Coos Bay, Oregon, USA, to Receive Contaminated Dredged Material,
W87-03263 5E

REEVES, D. W.
Effects of In-Row and Interrow Subsoiling and Time of Nitrogen Application on Growth, Stomatal Conductance and Yield of Strip-Tilled Corn,
W87-03170 3F

REICHARD, E. G.
Efficient Response Matrix Method for Coupling a Groundwater Simulator and a Regional Agricultural Management Model,
W87-02936 4B

REINHOLD, L.
Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: I. Salinity During Growth Modulates the Proton Pump in the Halophyte Atriplex Nummularia,
W87-02717 2I

Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: II. K(+) Strongly Promotes Development of Membrane Potential in Vesicles from Cotton Roots,
W87-02718 2I

REMSON, I.
Efficient Response Matrix Method for Coupling a Groundwater Simulator and a Regional Agricultural Management Model,
W87-02936 4B

RENSINK, J. H.
Phosphorus Removal at Low Sludge Loadings,
W87-02747 5D

RHEA, J. O.
Interim Progress Report, Volume I: SCPP Meteorological and Statistical Support for Period 1 September 1984 through 31 August 1985,
W87-03327 2B

RHOADES, J. D.
Production Function for Cotton with Dated Irrigation Quantities and Qualities,
W87-03189 3F

RIBAUDO, M. O.
Impacts of Water Quality Improvement on Site Visitation: A Probabilistic Modeling Approach,
W87-02622 4D

RICE, R. C.
Percolation of Water Below an Irrigated Field,
W87-02722 5B

Transport of Conservative Tracers in the Field Under Intermittent Flood Irrigation,
W87-03191 2G

RICHARDS, K. A.
Physical Environment Near the Surface of Plowed and No-Tilled Soils,
W87-03171 2G

RINDELS, A. J.
Designing Intakes to Avoid Free-Surface Vortices,
W87-03034 8B

RIONDO, M. C.
Nursery Irrigation-Syringe System That Monitors Environmental Parameters,
W87-03107 7C

RITZER, H. J.
Pond Maintenance,
W87-03018 4A

ROBBINS, J. A.
Partitioning of 7 Beryllium in Fresh Water,
W87-03142 5A

ROBERTS, D. J.
Effects of Cyanide on the Methanogenic Degradation of Phenolic Compounds,
W87-02709 5D

ROBERTS, R. S.
Voter Reactions to the 1976 Water Development and Quality Referenda in Texas,
W87-02944 6E

ROBINSON, D. L.
Influence of Climatic Factors and Forage Age on the Chemical Components of Ryegrass Related to Grass Tetany,
W87-02980 2I

ROBINSON, D. W.
Mill Creek Channel, Walla Walla, Washington: Hydraulic Model Investigation,
W87-03335 8B

ROBINSON, M.
Changes in Catchment Runoff Following Drainage and Afforestation,
W87-03072 4C

RODEN, C. M.
Zooplankton Fauna of Killary Harbour: The Seasonal Cycle of Abundance,
W87-03054 2L

RODGERS, A. B.
Ixtapa Draft Agreement Relating to the Use of Transboundary Groundwaters,
W87-02592 6E

RODHE, H.
Temporal Evolution of Nitrogen Compounds in Swedish Precipitation Since 1955,
W87-02812 2B

RODHOUSE, P. G.
Zooplankton Fauna of Killary Harbour: The Seasonal Cycle of Abundance,
W87-03054 2L

RODI, W.
Experiments on Vertical Plane Buoyant Jets in Shallow Water,
W87-02762 8B

ROLLINS, D. M.
Viable but Nonculturable Stage of Campylobacter jejuni and Its Role in Survival in the Natural Aquatic Environment,
W87-02899 5B

ROMBERGER, J. S.
Estimating Generalized Soil-water Characteristics from Texture,
W87-02727 2G

RONDININI, S.
Predicting Standard pH Values for Reference Buffer Solutions in Solvent Mixtures with Water,
W87-03049 5A

RONEN, D.
High Concentration of Solutes at the Upper Part of the Saturated Zone (Water Table) of a Deep Aquifer Under Sewage-Irrigated Land,
W87-02677 2F

ROOD, M. J.
Temporal Evolution of Nitrogen Compounds in Swedish Precipitation Since 1955,
W87-02812 2B

ROSE, J. B.
Detection of Rotavirus in Treated Drinking Water,
W87-02643 5B

Microbial Aspects of Wastewater Reuse for Irrigation,
W87-03129 3C

ROSENTHAL, L.
Amoco Cadiz and Limitation of Liability for Oil Spill Pollution: Domestic and International Solutions,
W87-02593 6E

ROSENZWEIG, W. D.
Fungi in Potable Water Distribution Systems,
W87-02614 5B

ROSS, C. W.
Effect of Subsoiling and Irrigation on Potato Production,
W87-03169 3F

ROSS, H. B.
Deposition of Atmospheric Trace Metals in Northern Sweden as Measured in the Snowpack,
W87-02720 5B

ROUVIERE, C.
Analysis and Cartographical Approach to the Regional Water Utilization System in the Yodo River Basin,
W87-02978 6D

ROVEL, J. M.
Importance of the Acidogenic Microflora in Biological Phosphorus Removal,
W87-02749 5D

RUNELLO, F.
Prevention and Treatment of Endemic Iodine-Deficiency Goiter by Iodination of a Municipal Water Supply,
W87-02779 5F

RUPPENEIT, K. V.
Two-Chamber Consolidation Press,
W87-03183 8D

RUSHTON, K. R.
Response to Pumping of a Weathered-Fractured Granite Aquifer,
W87-02676 2F

RUSSO, D.
Stochastic Approach to the Crop Yield-Irrigation Relationships in Heterogeneous Soils: I. Analysis of the Field Spatial Variability,
W87-02921 3F

Stochastic Approach to the Crop Yield-Irrigation Relationships in Heterogeneous Soils: II. Application to Irrigation Management,
W87-02922 3F

RUTGERS VAN DER LOEFF, M. M.
Benthic Fluxes of Cadmium, Copper, Nickel, Zinc and Lead in the Coastal Environment,
W87-03144 5B

Effect of Oxygen on Release and Uptake of Cobalt, Manganese, Iron and Phosphate at the Sediment-Water Interface,
W87-03143 5B

RYAN, J.
Soil Application of a Hydrophilic Conditioner in Relation to Moisture, Irrigation Frequency and Crop Growth,
W87-02881 3F

RYAN, T. H.
Zooplankton Fauna of Killary Harbour: The Seasonal Cycle of Abundance,
W87-03054 2L

SABATON, C.
Statistical Analysis of the Relationship Between Water Quality Parameters and Discharge at Eight Stations on the Rhine from 1959 to 1974 (Analyse Statistique des Relations Liant les Parametres de Qualite d'Eau et le Debit du Rhin en Huit Stations de 1959 a 1974),
W87-03282 5G

SABET, M. H.
Models for Water and Power Scheduling for the California State Water Project,
W87-02626 6A

SAGER, S. L.
Chemical Control of Soluble Phosphorus in the Amazon Estuary,
W87-03139 5B

SAILA, S. B.
Statistical Technique for Analysis of Environmental Data Containing Periodic Variance Components,
W87-02599 7C

SALAZAR, M. H.
Ecological Evaluation of Organotin-Contaminated Sediment,
W87-03254 5B

SALAZAR, S. M.
Ecological Evaluation of Organotin-Contaminated Sediment,
W87-03254 5B

SAMATA, T.
Contaminating Peptides Widely Present in Ion-Exchanged Water, Reagents, Experimental Implements and Natural Sample,
W87-02787 5B

SAMUI, R. P.
Compaction and Tillage Depth Combinations for Water Management and Rice Production in Low-Retentive Permeable Soils,
W87-03163 3F

SANDERSON, B.
Vertical Diffusion in Meromictic Powell Lake, British Columbia,
W87-02780 2H

SANDHEINRICH, M. B.
Environmental Effects of Dikes and Revetments on Large Riverine Systems,
W87-03321 6G

SANVILLE, W. D.
Environmental Gradients in Northwest Freshwater Wetlands
W87-02615 2H

SARKAR, A. K.
Forms of Nitrogen in Waterlogged Soils and Their Contribution to Yield and Nitrogen Uptake by Rice,
W87-03158 3C

SARKAR, H. L.
Association Between Some Planktonic Species and Physicochemical Characteristics of the Water of Loktak Lake, Manipur, India,
W87-03025 2H

SARKKULA, J.
Three-dimensional Water-Quality-Transport Model Compared with Field Observations,
W87-02970 2H

SARSFIELD, A. C.
Drip and Minis, in the Commercial Landscape,
W87-02948 3F

Sprinkler Spacing Patterns,
W87-02947 3F

Water Distribution Profiles for Sprinklers,
W87-02946 3F

SARTORIS, J. J.
Primary Productivity (C14) at Twin Lakes Colorado: 1973-81 Study Results,
W87-03326 2H

SARTORY, D. P.
Membrane Filtration Enumeration of Faecal Clostridia and Clostridium Perfringens in Water,
W87-02701 5A

SASKI, T.
Influence of Accumulating Organic Sediment on the Marine Environment in Osaka Bay,
W87-03257 5C

SATO, A.
Study of Dissolved Oxygen Budgets in Natural and Artificial Lakes,
W87-02976 2H

SATO, K.
Dewatering of Bottom Sediments,
W87-03261 2J

Modelling of Industrial Ecological Systems for Evaluation of Health Services,
W87-02979 4C

SATTAR, S. A.
Rotavirus Survival in Raw and Treated Waters and Its Health Implications,
W87-02644 5G

SAVAGE, E. L.
Medical Geology,
W87-02825 5C

SAXTON, K. E.
Estimating Generalized Soil-water Characteristics from Texture,
W87-02727 2G

SCALISE, M. A.
Dual-use Filters Keep Wet-weather Flows Under Control,
W87-02926 5D

SCHAACK, F.
Problem of Phosphorus in France - Its Presence in Natural Waters and Biological Phosphorus Removal,
W87-02734 5G

SCHALEKAMP, M.
Water Supply of Varanasi - The Oldest City of India,
W87-03039 5F

SCHEUERMAN, P. R.
Bacteria and Viruses in Aerobically Digested Sludge: Influence of Physical and Chemical Treatments on Survival and Association with Flocs under Laboratory Conditions,
W87-02660 5D

SCHILLING, T.
Direct Determination of Cd, Cu and Ni in the Elbe River Estuary with Zeeman AAS and Matrix Modification (Direktbestimmung von Cd, Cu and Ni im Elbeastuar mit Hilfe der Zeeman-Atomabsorptionsspektroskopie und Matrixmodifikation),
W87-03087 5A

SCHMITT, R. W.
Selective Withdrawal From Any Level Between Minimum Pool and Spillway Elevation at Stonewall Jackson Dam, West Virginia,
W87-03245 8A

SCHNATTINGER, A.
Detection of Hepatitis A Virus in Drinking Water by Enzyme-Immunoassay Using Ultracentrifugation for Virus Concentration,
W87-02647 5A

SCHNEIDER, M. L.
Operational Tools: Optimal Control of Reservoir Water Quality,
W87-03239 5G

SCHOELL, M.
Biogenic Methane Formation in Marine and Freshwater Environments: CO2 Reduction vs. Acetate Fermentation-Isotope Evidence,
W87-03137 5B

SCHOENEN, D.
Drinking Water Materials: Field Observations and Methods of Investigation,
W87-03340 5F

SCHOLER, H. F.
Drinking Water Materials: Field Observations and Methods of Investigation,
W87-03340 5F

SCHOLTEN, A.
Some Physiological Characteristics of Acinetobacter spp. Accumulating Large Amounts of Phosphate,
W87-02742 5D

SCHOOLMASTER, F. A.
Voter Reactions to the 1976 Water Development and Quality Referenda in Texas,
W87-02944 6E

SCHOUTEN, C. J.
Budget of Water and Its Constituents for Lake Taupo (New Zealand),
W87-03295 2H

SCHRODER, L. J.
Evaluation of Methods for Preservation of Water Samples for Nutrient Analysis,
W87-03030 5A

SCHULTE-WULWER-LEIDIG, A.
Runoff Processes and Dissolved Substances During Flood Events in Small Differently Used Drainage Areas,
W87-03283 2E

SCHWARZENBACH, R. P.
Sorption of Hydrophobic Trace Organic Compounds in Groundwater Systems,
W87-02730 5B

SCIARONI, R. H.
Water Conservation and Recycling in Ornamentals Production,
W87-02957 3F

SEBACHER, D. I.
Atmospheric Methane Sources: Alaskan Tundra Bogs, an Alpine Fen, and a Subarctic Boreal Marsh,
W87-02719 5B

SEBACHER, S. M.
Atmospheric Methane Sources: Alaskan Tundra Bogs, an Alpine Fen, and a Subarctic Boreal Marsh,
W87-02719 5B

SEHAYEK, L.
Modeling Leachate Production from Municipal Landfills,
W87-02883 5B

SEIBEL, D.
Hydraulic Design: Bloomington Lake and F. E. Walter Dam Project's Selective Withdrawal Structures,
W87-03233 8A

SEITZ, M. G.
Adsorption of Select Phenol Derivatives by Dolomite,
W87-02583 5B

SELIM, H. M.
Goodness of Fit for Eight Water Infiltration Models,
W87-02923 2G

SELMER, J.-S.
New Procedure for Extraction of Ammonium from Natural Waters for 15N Isotopic Ratio Determinations,
W87-02902 5A

SELTZER, M. A.
Possible Role of Symmetric Instability in the Formation of Precipitation Bands,
W87-03213 2B

SEMONIAN, R. C.
Mussel Watch Program/Monitoring the Long-Term Effects of Dredged Material Disposal in New England Waters,
W87-03270 5B

SERIE, CH.
Detection of Indigenous Enteric Viruses in Raw Sewage Effluents of the City of Athens, Greece, during a Two Year Survey,
W87-02659 5B

SERRANO, S. E.
Analysis of Stochastic Groundwater Flow Problems. Part II: Stochastic Partial Differential Equations in Groundwater Flow. A Functional-Analytic Approach,
W87-02843 2F

Analysis of Stochastic Groundwater Flow Problems. Part III: Approximate Solution of Stochastic Partial Differential Equations,
W87-02844 2F

Analysis of Stochastic Groundwater Problems. Part I: Deterministic Partial Differential Equations in Groundwater Flow. A Functional-Analytic Approach,
W87-02842 2F

SEVENARD, YU. K.
Effective Technology of Constructing Earth Structures,
W87-02864 8A

SHALHEVET, J.
Irrigation Interval as a Factor in Sweet Corn Response to Salinity,
W87-03003 3C

SHANNON, F. T.
Exposure to Fluoridated Public Water Supplies and Child Health and Behaviour,
W87-03092 5C

SHARP, D. N.
Failure to Detect Cytopathic Enteroviruses in Drinking Water,
W87-02654 5A

SHARP, J. J.
Effect of Waves on Buoyant Jets,
W87-02964 5B

SHARPLES, K.
Enterovirus Removal from Sewage: The Effectiveness of Four Different Treatment Plants,
W87-02706 5D

SHEA, P. H.
Fluridone Retention and Release in Soils,
W87-02918 5B

SHELLEY, F. M.
Voter Reactions to the 1976 Water Development and Quality Referenda in Texas,
W87-02944 6E

SHEN, Z. S.
Waterhammer Pressure Compensation in Turbine Regulating Systems,
W87-02690 8C

SHEPPARD, S. M. F.
Organic Water: Isotopic Characterization and Evidence for Its Role in the Fedj-el-Adoum Pb-Zn Deposit, Tunisia (Eau organique: caracterisation isotopique et evidence de son role dans le gisement Pb-Zn de Fedj-el-Adoum, Tunisie),
W87-03090 5B

SHIBATA, M.
Factors Affecting Biological Removal of Phosphorus,
W87-02748 5D

SHIMOHARA, E.
Virus Removal by Activated Sludge Treatment,
W87-02658 5D

SHIN, H. K.
Behaviour of Coliphages in Oxidation Ponds,
W87-02666 5D

SHIPILOV, A. V.
Restoration of Pipe Drainage in Foundations of Hydraulic Structures on Carbonate Rocks,
W87-03184 8A

SHIRREFF, W. J.
Getting Your Money's Worth from Computer Based Control Systems - Part 1,
W87-03120 5D

SHITASHIMA, K.
Determination of Organically-associated Trace Metals in Estuarine Sea-Water by Solvent Extraction and Atomic-Absorption Spectrometry,
W87-03173 5A

SHOCKEY, M. W.
Evaluation of Methods for Preservation of Water Samples for Nutrient Analysis,
W87-03030 5A

SHORTLE, J. S.
Impacts of Water Quality Improvement on Site Visitation: A Probabilistic Modeling Approach,
W87-02622 4D

SICKELS, F. A.
Growth and Survival of Giant Ragweed (Ambrosia trifida L.) in a Delaware River Freshwater Tidal Wetland,
W87-03207 2H

SIEGEL, D. I.
Hydraulic Conductivity and Related Physical Properties of Peat, Lost River Peatland, Northern Minnesota,
W87-02715 2G

SILVA, M.
Indirect Atomic Absorption Determination of Anionic Surfactants in Wastewaters by Flow Injection Continuous Liquid-Liquid Extraction,
W87-03048 5A

SILVERBERG, N.
Early Diagenesis of Cadmium and Cobalt in Sediments of the Laurentian Trough,
W87-03138 5B

SIMITZIS-LE-FLOHIC, A. M.
Sanitary Study of Surface Water and of the Beach of a Water Sports and Leisure Complex,
W87-02777 5B

SIMONNOT, D.
Delay of Reaction Turbines and Pumps to Transient States, (Retard des Turbines a Reaction et des Pompes dans Leur Comportement en Regime Transitoire),
W87-02581 8C

SIMONS, T. S. J.
Phosphorus Removal at Low Sludge Loadings,
W87-02747 5D

SIMPSON, G. M.
Inexpensive System Using Drip-Emitters for Irrigating Small Plots,
W87-02876 3F

SIMPSON, R. L.
Growth and Survival of Giant Ragweed (Ambrosia trifida L.) in a Delaware River Freshwater Tidal Wetland,
W87-03207 2H

SINCLAIR, C. D.
Classification of Drainage Basins According to their Physical Characteristics; An Application for Flood Frequency Analysis in Scotland,
W87-02683 2E

SINCLAIR, T. R.
Gas Exchange of Field-Grown Soybean Under Drought,
W87-02999 2I

SINGH, B. K.
Groundwater Occurrences in the Hard Rock Terrains of Sri Lanka - A Case Study,
W87-03047 2F

SINGH, R. N.
Correlation of Metal-Organic Fractions with Soil Properties in Sewage-Sludge-Amended Soils,
W87-02714 5E

SINGHAL, D. C.
Aquifer Transmissivity of Porous Media from Resistivity Data,
W87-02837 7B

SINGLEY, J. E.
Effects of Water Quality Parameters on the Corrosion of Galvanized Steel,
W87-02608 5G

SINHA, N. P.
Forms of Nitrogen in Waterlogged Soils and Their Contribution to Yield and Nitrogen Uptake by Rice,
W87-03158 3C

SINHA, R. S.
Tunnels: Machine Excavation - Rate of Progress - Machine Data,
W87-03320 8A

SIRON, R.
Distribution of Anionic Surfactants in the Water Column of the Gulf of Fos-sur-Mer, (Distribution des Detergents Anioniques dans la Colonne d'Eau du Golfe de Fos-sur-Mer),
W87-02563 5B

SITHOLE, B. B.
Halogenated Phenols in Water at Forty Canadian Potable Water Treatment Facilities,
W87-03112 5F

SKAGGS, R. W.
Drains as a Boundary Condition in Finite Elements,
W87-03201 2F

SKIMINA, C. A.
Recycling Irrigation Runoff on Container Ornamentals,
W87-02956 3F

SKOGERBOE, G. V.
Ecological Modelling, Monitoring and Implementation in Irrigated Agriculture,
W87-02966 3F

SLADE, J. S.
Viruses and Bacteria in a Chalk Well,
W87-02655 5B

SLOTTA, L. S.
Flow Processes of a Cutterhead Dredge,
W87-03262 8C

SMITH, A. M.
Alcohol Dehydrogenase Activity in the Roots of Marsh Plants in Naturally Waterlogged Soils,
W87-02816 2I

SMITH, C. J.
Radionuclide Concentrations in Louisiana Soils and Sediments,
W87-03085 5B

SMITH, D. G.
Plains Cottonwood Recruitment and Survival on a Prairie Meandering River Floodplain, Milk River, Southern Alberta and Northern Montana,
W87-02769 2I

SMITH, D. L.
Leaf Litter Processing and the Associated Invertebrate Fauna in a Tallgrass Prairie Stream,
W87-03097 2H

SMITH, G. N.
Efficient Method of Applying Aluminum Salts for Sediment Phosphorus Inactivation in Lakes,
W87-02635 5G

SMITH, I.
Effectiveness of Capping in Isolating Dutch Kills Sediment from Biota and the Overlying Water,
W87-03332 5G

SMITH, J. P.
Influence of Catastrophic Floods on Water Quality as Recorded in the Sediments of Blagdon Lake, England,
W87-03306 2H

SMITH, R. L.
Extreme Value Theory Based on the r Largest Annual Events,
W87-03069 2L

Long Distqance Water Rights,
W87-02637 6E

SMITH, S. E.
General Impact of Aswan High Dam,
W87-03066 6G

SNYDER, R. D.
Effect of Standing Small Grain Stubble on Snow Cover Characteristics in Alternate Fallow Strip Cropping,
W87-02990 2C

SOBSEY, M. D.
Detection of Hepatitis A Virus (HAV) in Drinking Water,
W87-02646 5A

SOLCHAGA, M.
Flame Absorption Spectroscopic Determination of Cadmium, Copper, Iron, Lead, and Zinc in Mussels,
W87-03115 5A

SOMER, E.
Nitrate Load/Discharge Relationships and Nitrate Load Trends in Danish Rivers,
W87-03302 5B

SOMIYA, I.
Rational Allocation of Monitoring Stations in a Lake by Means of the Spline Technique,
W87-02598 7A

SONENSHEIN, D. A.
Abstention: The Crooked Course of Colorado River,
W87-02596 6E

SONNEBORN, M.
Multielement Trace Preconcentration from Water on Activated Carbon for the Sample Pretreatment for Atomic Spectroscopy (Flame-AAS, ICP/OES), (Multielement-Spurenanreicherung aus Wassern an Aktivkohle zur Probenvorbereitung fur die Atomspektroskopie (Flammen-AAS, ICP/OES)),
W87-02799 5A

SONZOGNI, W. C.
Effect of Influent Phosphorus Reductions on Great Lakes Sewage Treatment Costs,
W87-02630 5D

SORENSSON, F.
New Procedure for Extraction of Ammonium from Natural Waters for 15N Isotopic Ratio Determinations,
W87-02902 5A

SORG, C. F.
Existence Values and Normative Economics: Implications for Valuing Water Resources,
W87-03188 6B

SOUKUP, M. A.
Impacts from Mosquito Control-Induced Sulphur Mobilization in a Cape Cod Estuary,
W87-03127 5C

SOUTHERLAND, M. T.
Effects of Variation in Streamside Habitats on the Composition of Mountain Salamander Communities,
W87-03082 2H

SOUTHWORTH, G. R.
Anomalous Binding of Organic Contaminants May Be Artifactual Due to Radiochemical Impurities,
W87-02700 5A

SPAGNOLI, J. J.
Managing the Industrial/Hazardous Contributions to the Niagara River,
W87-02828 5G

SPARACINO, C.
Concentrations of 20 Volatile Organic Compounds in the Air and Drinking Water of 350 Residents of New Jersey Compared with Concentrations in Their Exhaled Breath,
W87-02774 5B

SPATZIERER, G.
Biological Phosphorus Removal in Combination with Simultaneous Precipitation,
W87-02746 5D

SPECHT, J. E.
Use of Portable Rainout Shelters to Induce Water Stress,
W87-02991 2I

Water Use Efficiency in Soybean Pubescence Density Isolines-A Calculation Procedure for Estimating Daily Values,
W87-03000 2I

SPEECE, R. E.
Effects of Chloroform Toxicity on Methane Fermentation,
W87-02704 5D

SPICKERMANN, W.
Studies on Sediments of the River Lahn: 1. Analytical Results, (Untersuchungen an Lahnsedimenten: 1. Analytische Ergebnisse),
W87-02800 5B

Studies on Sediments of the River Lahn: 2. Chemometric Evaluation, (Untersuchungen an Lahnsedimenten: 2. Chemometrische Auswertung),
W87-02801 5B

SPIKER, E. C.
Dissolved Organic Matter in Anoxic Pore Waters from Mangrove Lake, Bermuda,
W87-03136 5A

SPILLMANN, S. K.
Method for Determining Virus Inactivation During Sludge Treatment Processes,
W87-02898 5A

SPOMER, L. A.
Techniques for Measuring Plant Water,
W87-02950 7B

SPRAGUE, J. B.
Absence of Acclimation to Parathion by Rainbow Trout During Sublethal Exposure,
W87-02697 5C

SPRINGTHORPE, V. S.
Rotavirus Survival in Raw and Treated Waters and Its Health Implications,
W87-02644 5G

SPURR, A. R.
Responses of Lettuce to Salinity. I. Effects of NaCl and Na2SO4 on Growth,
W87-03154 5C

Salt Responses of Lettuce to Salinity. II. Effect of Calcium on Growth and Mineral Status,
W87-03155 5C

SPYROU, N.
Detection of Indigenous Enteric Viruses in Raw Sewage Effluents of the City of Athens, Greece, during a Two Year Survey,
W87-02659 5B

SQUATRITO, S.
Prevention and Treatment of Endemic Iodine-Deficiency Goiter by Iodination of a Municipal Water Supply,
W87-02779 5F

STAHLY, E. A.
Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. I. Soil Moisture, Water Relations, Tree and Fruit Growth,
W87-03110 3F

Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. II. Mineral Composition of Fruit and Leaves, Fruit Disorders, and Fruit Set,
W87-03111 3F

STALLINGS, E. A.
Evolution of PMP Cooperative Studies,
W87-03063 8A

STANLEY, C. D.
Interactive Effects of Trickle Irrigation Rates, Cultivars, and Culture on Cut Chrysanthemum,
W87-02959 3F

STARK, D.
Alkali-Silica Reactivity in Five Dams in Southwestern United States,
W87-03319 8F

STARK, J. C.
Changes in Spring Wheat Tillering Patterns in Response to Delayed Irrigation,
W87-03012 2I

STEELE, D. P.
Soil Potential Ratings for Onsite Wastewater Disposal,
W87-02860 5E

STEELE, T. D.
Regional Analysis of Water Quality in Major Streams of the United States,
W87-03284 5G

STEEN, R. W. J.
Evaluation of Effluent from Grass Silage as a Feed for Beef Cattle Offered Silage-based Diets,
W87-03099 5E

STEFAN, H. G.
Passive Screen Water Intake Design Studies,
W87-02767 8I

STEIMLE, F. W.
Organic and Trace Metal Levels in Ocean Quahog, Arctica islandica Linne, from the Northwestern Atlantic,
W87-02759 5B

STEINER, J. L.
Dryland Grain Sorghum Water Use, Light Interception, and Growth Response to Planting Geometry,
W87-03008 2I

Response of Conservation Tillage Sorghum to Growing Season Precipitation,
W87-03167 3F

STEINMAN, A. D.
Effects of Current Velocity and Light Energy on the Structure of Periphyton Assemblages in Laboratory Streams,
W87-02808 2H

STEPHENSON, D.
Real-Time Kinematic Catchment Model for Hydro Operation,
W87-02766 2E

STEVENSON, A. C.
Lake Acidification and the Land-Use Hypothesis: A Mid-Post-Glacial Analogue,
W87-02810 2K

STEVENSON, D. S.
Effect of Woven Plastic Mulch, Herbicides, Grass Sod, and Nitrogen on 'Foch' Grapes Under Irrigation,
W87-03106 3F

Effects of Frequency of Irrigation on Nutrient Uptake of Apple Trees,
W87-02875 3F

STEYN, P. L.
Aut-Ecological Study of Acinetobacter in Activated Sludge,
W87-02744 5D

STITT, T. A.
Establishing a Stormwater Management Utility,
W87-03123 2E

STODDARD, A.
Lead Dissolution From Soldered Joints,
W87-02607 5B

STOERK, S.
Preservation of Traces of Chromium(VI) in Water and Waste Water Samples,
W87-02804 5A

STORK, G.
Studies on Sediments of the River Lahn: 1. Analytical Results, (Untersuchungen an Lahnsedimenten: 1. Analytische Ergebnisse),
W87-02800 5B

Studies on Sediments of the River Lahn: 2. Chemometric Evaluation, (Untersuchungen an Lahnsedimenten: 2. Chemometrische Auswertung),
W87-02801 5B

STOW, C. D.
Measurements of pH versus Drop Size in Natural Rain,
W87-02811 2B

STURGIS, T. C.
Effectiveness of Capping in Isolating Dutch Kills Sediment from Biota and the Overlying Water,
W87-03332 5G

STURMAN, L. S.
Concentration of Seeded and Naturally Occurring Enteroviruses from Waters of Varying Quality by Hollow Fiber Ultrafiltration,
W87-02648 5A

STYNER, W. A.
Evolution of PMP Cooperative Studies,
W87-03063 8A

SUBRAMANIAN, V.
Factors Controlling the Chemical Composition of River Waters of India,
W87-03285 2E

SUBRAMANYAM, T. K.
Compaction and Tillage Depth Combinations for Water Management and Rice Production in Low-Retentive Permeable Soils,
W87-03163 3F

SUDO, R.
Model of Nitrogen Release from Bottom Sediments,
W87-03250 5B

Study of Dissolved Oxygen Budgets in Natural and Artificial Lakes,
W87-02976 2H

SUEISHI, T.
Analysis and Cartographical Approach to the Regional Water Utilization System in the Yodo River Basin,
W87-02978 6D

SUGISHIMA, S.
Virus Removal by Activated Sludge Treatment,
W87-02658 5D

SUMITOMO, H.
Some Experimental Discussion of Accuracies in Quantitative Virus Assessment for Water Supply,
W87-02656 5A

SUN, N. Z.
Upstream Weight Multiple-Cell Balance Finite-Element Method for Solving Three-Dimensional Convection-Dispersion Equations,
W87-03197 2F

SUNDA, W. G.
Relationships Among Growth Rate, Cellular Manganese Concentrations and Manganese Transport Kinetics in Estuarine and Oceanic Species of the Diatom Thalassiosira,
W87-02805 2L

SUNDBY, B.
Early Diagenesis of Cadmium and Cobalt in Sediments of the Laurentian Trough,
W87-03138 5B

Effect of Oxygen on Release and Uptake of Cobalt, Manganese, Iron and Phosphate at the Sediment-Water Interface,
W87-03143 5B

SURESH, N.
New Strategies for the Isolation of Microorganisms Responsible for Phosphate Accumulation,
W87-02740 5D

SUSSMANN, W.
Comparison of Water Quality in Drainage Basins Under Agricultural and Forest Land Use,
W87-03307 2E

SUTER, O.
Preservation of Traces of Chromium(VI) in Water and Waste Water Samples,
W87-02804 5A

SUZUKI, M.
Modelling of the Lower Trophic Levels of a Marine Ecosystem and Its Example of Short-period Variations of Chlorophyll and Nutrient in Harima-Nada,
W87-02601 2L

SWIADER, J. M.
Seasonal Growth and Composition and Accumulation of N-P-K in Dryland and Irrigated Pumpkins,
W87-03150 2I

SWIFT, M. R.
Development of a Collision Tolerant Pile Structure Concept,
W87-03219 8A

SWIHART, T.
Antidegradation Policy for Preserving Surface Water Quality in Florida,
W87-02636 5G

SYVERTSEN, J. P.
Integration of Water Stress in Fruit Trees,
W87-02952 2I

SZEVERENYI, N. M.
Dissolved Organic Matter in Anoxic Pore Waters from Mangrove Lake, Bermuda,
W87-03136 5A

T'SEYEN, J.
Polyphosphate Kinase Activity during Phosphate Uptake by Bacteria,
W87-02736 5D

TAGUCHI, S.
Dewatering of Bottom Sediments,
W87-03261 2J

TAKASAKI, M.
Study of Dissolved Oxygen Budgets in Natural and Artificial Lakes,
W87-02976 2H

TAKESHITA, T.
Bioaccumulation of Arsenic by Freshwater Algae and the Application to the Removal of Inorganic Arsenic from an Aqueous Phase: Part II. by Chlorella vulgaris Isolated from Arsenic-Polluted Environment,
W87-02907 5B

TAL, M.
Potassium Utilization and Fluxes in Wild Salt-Tolerant Relatives of the Cultivated Tomato,
W87-03055 2I

TALBERT, R. E.
Herbicides and Seeding Rate Effects on Sprinkler-Irrigated Rice,
W87-03013 2I

TALEISNIK-GERTEL, E.
Potassium Utilization and Fluxes in Wild Salt-Tolerant Relatives of the Cultivated Tomato,
W87-03055 2I

TANAKA, T.
Interactive Algorithm for the Parameter Estimation of Complex Systems and Its Application to an Ecological Modelling of an Actual Japanese Lake,
W87-02600 2H

TANIMOTO, M.
In Situ Stream Water Clarifying Tests,
W87-03265 5G

TANIMOTO, T.
Wastewater Treatment by Soil,
W87-03264 5D

TATE, D. M.
Structural Change Implications for Industrial Water Use,
W87-03190 6D

TAULAN, J. P.
Overpressure Peak in Dual Horizontal Francis Turbines: Industrial Experiments Results, (Pic de Surpression des Francis Horizontales Doubles: Resultats d'Experiences Industrielles),
W87-02578 8C

TAYLOR, B. E.
Hydrogen Isotope Study of Large-Scale Meteoric Water Transport in Northern California and Nevada,
W87-02686 2F

TAYLOR, D. A.
Snow Loads in the 1985 National Building Code of Canada: Curved Roofs,
W87-02667 2C

TAYLOR, G. R.
Electrofocusing of Viruses and Sensitivity to Disinfection,
W87-02664 5D

TAYLOR, K. R.
Generalization and Applications of Tracer Dispersion Data,
W87-02620 5B

TAYLOR, R. L.
Red Alder Leaf Litter and Streamwater Quality in Western Oregon,
W87-02631 5B

TEAGUE, L. S.
Research Design for Tucson Aqueduct, Phase B Data Recovery,
W87-03328 6G

TEAL, D. L. E.
Cordless Geo-Data Link,
W87-03031 7B

TEDER, R. I.
Analysis of Methods of Determining the Compressive Strength of Rocks,
W87-03180 8E

TEKELI, S.
Computerized Layout Generation for Sanitary Sewers,
W87-03062 8A

TELLAM, J. H.
Morphology of a Saline Groundwater Body: Its Investigation, Description and Possible Explanation,
W87-02849 2F

TERNAN, J. L.
Stream Solute Sources and Variations in a Temperate Granite Drainage Basin,
W87-03296 5B

TETREAULT, M. J.
Biological Phosphorus Removal: A Technology Evaluation,
W87-02820 5D

THALLER, A.
Determination of Halogenated Solvent Residues in Water, Waste Water, Feeding-Stuffs, and Food, (Bestimmung halogenierter Losungsmittelrueckstande in Wasser, Abwasser, Futter- und Lebensmitteln),
W87-03086 5A

THOMAS, O. M.
Response to Waterlogging and Differing Sensitivity to Divalent Iron and Manganese in Clones of Dactylis glomerata L. Derived from Well-Drained and Poorly-Drained Soils,
W87-03095 5C

THOMAS, R. B.
Measuring Suspended Sediment in Small Mountain Streams,
W87-03324 5A

THOMPSON, J. C.
Safe Drinking Water Act,
W87-03122 6E

THOMPSON, L. M.
Climatic Change, Weather Variability, and Corn Production,
W87-03006 2I

THOMPSON, S. M.
Transport of Gravel by Flows up to 500 cu m/s, Ohau River, Otago, New Zealand,
W87-02773 2J

THOMS, M. C.
Wave Movement and Water-Quality Variations During a Controlled Release from Kielder Reservoir, North Tyne River, U. K.,
W87-02681 2E

THOMSEN, H. H.
Placers of Cosmic Dust in the Blue Ice Lakes of Greenland,
W87-02913 2C

THOR, D.
Crater Lake, Oregon: A Restricted Basin with Base-of-Slope Aprons of Nonchannelized Turbidites,
W87-03220 2J

THORHAUG, A.
Stemming the Loss of Coastal Wetland Habitats: Jamaica as a Model for Tropical Developing Countries,
W87-03128 2L

THURNHEER, T.
Orthanilic Acid and Analogues as Carbon Sources for Bacteria: Growth Physiology and Enzymic Desulphonation,
W87-02781 5D

TIMMERMAN, M.
New Strategies for the Isolation of Microorganisms Responsible for Phosphate Accumulation,
W87-02740 5D

TINDALL, T. A.
Influence of Soil Structure on Movement Rate of Salts Through Soils,
W87-02716 5B

TOEI, K.
Fluorometric Determination of Nitrite in Natural Waters with 3-Aminonaphthalene-1,5-disulphonic Acid by Flow-Injection Analysis,
W87-03172 5A

TOLBERT, R. D.
Nutrient Transformation in Retention/Detention Ponds Receiving Highway Runoff,
W87-02821 5D

TORANZOS, G. A.
Detection of Rotavirus in Treated Drinking Water,
W87-02643 5B

TOSHIMA, H.
65 MW Bulb Turbine for Japan's Tadami Project,
W87-02691 8C

TOUCHTON, J. T.
Effects of In-Row and Interrow Subsoiling and Time of Nitrogen Application on Growth, Stomatal Conductance and Yield of Strip-Tilled Corn,
W87-03170 3F

TRANAIN, A.
Small Power Stations Abroad, (Aspects Specifiques de Minicentrales a l'Etranger),
W87-02566 8C

TRAUB, F.
Method for Determining Virus Inactivation During Sludge Treatment Processes,
W87-02898 5A

TRETTENBACH, J.
Determination of Lead, Cadmium and Thallium in Water Samples at ppb and ppt Levels by Isotope Dilution Mass Spectrometry, (Bestimmung von Blei, Cadmium und Thallium in Wasserproben im ppb- und ppt-Bereich durch massenspektrometrische Isotopenverdunnungsanalyse),
W87-02795 5A

TREVORS, J. T.
R-Plasmid Transfer in Soil and Water,
W87-02792 5C

TROY, M. A.
Comparison of Clark's Presence-Absence Test and the Membrane Filter Method for Coliform Detection in Potable Water Samples,
W87-02892 5A

TRUDEL, M.
Detection and Health Risk Associated with Low Virus Concentration in Drinking Water,
W87-02653 5A

TRUONG, M. Q. M.
Adaptation of an Existing Sill for Installation of a Siphon Plant, (Adaptation d'un Seuil Existant pour l'Implantation d'un Groupe en Siphon),
W87-02574 8C

TSUBOTA, H.
Determination of Organically-associated Trace Metals in Estuarine Sea-Water by Solvent Extraction and Atomic-Absorption Spectrometry,
W87-03173 5A

TSUCHIYA, K.
Modelling of Industrial Ecological Systems for Evaluation of Health Services,
W87-02979 4C

TSUKERMAN, Y. N.
Characteristics of the Static Performance of Dams Reservoired Hydroelectric Stations,
W87-02866 8A

TSUNO, H.
Rational Allocation of Monitoring Stations in a Lake by Means of the Spline Technique,
W87-02598 7A

TUCKER, T. C.
Ammonium (15N) Metabolism in Cotton Under Salt Stress,
W87-03151 5C

TUILLIER, M.
Problems Encountered in The Operation of Small Power Plants, (Problemes Rencontres a la Mise en Service de Microcentrales),
W87-02572 8C

TURNER, R.
Review of Selective Withdrawal Performance in the Fort Worth District,
W87-03229 6B

TYAGI, R. D.
Functional Design of Activated Sludge Processes with Heavy Metal Inhibition,
W87-03131 5D

TYUKHANOV, Y. N.
Dimensionless Analysis of Optimum Designs,
W87-03185 8A

UBEL, J. R.
Flow Equalizing Saves Time and Money,
W87-03124 5D

UHL, V. W.
Results of Pumping Tests in the Deccan Trap Basalts of Central India,
W87-03076 2F

UKITA, M.
Study on Chemical Behavior Between Sediment and Upper Water,
W87-03251 2J

Study on the Modelling of the Behavior of Phosphorus Released from Sediments,
W87-02967 2L

UMA, K. O.
Comparative Analysis of Transmissivity and Hydraulic Conductivity Values from the Ajali Aquifer System of Nigeria,
W87-02859 2F

UNDERSANDER, D. J.
Management of Sorghum Under Limited Irrigation,
W87-02987 3F

UNGER, P. W.
Response of Conservation Tillage Sorghum to Growing Season Precipitation,
W87-03167 3F

Wheat Residue Management Effects on Soil Water Storage and Corn Production,
W87-02924 3F

UNNY, T. E.
Analysis of Stochastic Groundwater Flow Problems. Part II: Stochastic Partial Differential Equations in Groundwater Flow. A Functional-Analytic Approach,
W87-02843 2F

Analysis of Stochastic Groundwater Flow Problems. Part III: Approximate Solution of Stochastic Partial Differential Equations,
W87-02844 2F

Analysis of Stochastic Groundwater Problems. Part I: Deterministic Partial Differential Equations in Groundwater Flow. A Functional-Analytic Approach,
W87-02842 2F

Application of Computer Intensive Statistics to Parameter Uncertainty in Streamflow Synthesis,
W87-02945 2E

UNVALA, S. P.
Water and the Third Millennium,
W87-03044 5F

UTTON, A. E.
Ixtapa Draft Agreement Relating to the Use of Transboundary Groundwaters,
W87-02592 6E

VAIRAVAMURTHY, A.
Determination of Acrylic Acid in Aqueous Samples by Electron Capture Gas Chromatography after Extraction with Tri-n-octylphosphine Oxide and Derivatization with Pentafluorobenzyl Bromide,
W87-02818 5A

VALCARCEL, M.
Indirect Atomic Absorption Determination of Anionic Surfactants in Wastewaters by Flow Injection Continuous Liquid-Liquid Extraction,
W87-03048 5A

VALENTA, P.
Trace Determination of Chromium in Various Water Types by Adsorption Differential Pulse Voltammetry,
W87-02797 5A

VALLEY, D.
Waterline Problems can be Avoided with Care and Testing,
W87-02904 8A

VAN BAVEL, C. H. M.
Resistance of Plant Roots to Water Loss,
W87-03005 2I

VAN DEN BERG, J. A.
Algorithm for Computing the Relationship between Diffusivity and Soil Moisture Content from the Hot Air Method,
W87-02856 2G

VAN GILS, G.
Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial Wastewater Reuse and Priority Pollutant Removal,
W87-02753 5D

VAN HA, T.
Physiological Innocuity of Asbestos in Water,
W87-02831 5C

VAN HAVEREN, B. P.
Management of Instream Flows through Runoff Detention and Retention,
W87-02934 4A

VAN LOOSDRECHT, M.
Some Physiological Characteristics of Acinetobacter spp. Accumulating Large Amounts of Phosphate,
W87-02742 5D

VAN STADEN, J. F.
Automated Prevalve Dilution in Flow-Injection Analysis: The Automated Determination of Chloride in Surface, Ground and Domestic Water,
W87-02793 5A

VAN VLEET, E. S.
Acyclic Archaebacterial Ether Lipids in Swamp Sediments,
W87-03141 5A

VASENKO, Y. A.
Use of Grouting When Driving Through the Rock Burst Zone in the Dangara Irrigation Tunnel,
W87-03181 8E

VELO, C.
Analysis of Transient Phenomena in Hydroelectric Generation Plants, (Calcul des Transitoires dans les Installations Hydrauliques de Production d'Energie),
W87-02580 8C

VENTURA, T. S.
Effect of Cultivated and Wild Rice Varieties on the Nitrogen Balance of Flooded Soil,
W87-02813 2I

VERDONCK, O.
Effect of Short-term Water Stress on Leaf Gas Exchange Processes and Plant Water Potential in Schefflera,
W87-03104 2I

VIDENEEV, V. P.
Two-Chamber Consolidation Press,
W87-03183 8D

VIGNERI, R.
Prevention and Treatment of Endemic Iodine-Deficiency Goiter by Iodination of a Municipal Water Supply,
W87-02779 5F

VIK, E. A.
Effects of Corrosion Control of Low Alkalinity Waters - Norwegian Experiences,
W87-03045 5F

VILLENEUVE, J. P.
Estimation of Wastewater Treatment Costs: Evaluation of the CAPDET Model for Canadian Conditions,
W87-02670 5D

Functional Design of Activated Sludge Processes with Heavy Metal Inhibition,
W87-03131 5D

VILLESOT, D.
Problem of Phosphorus in France - Its Presence in Natural Waters and Biological Phosphorus Removal,
W87-02734 5G

VINCONNEAU, J. C.
Problem of Phosphorus in France - Its Presence in Natural Waters and Biological Phosphorus Removal,
W87-02734 5G

VINES, K. W.
Comparison of Sprinkler and Flood Irrigation for Rice,
W87-03004 3F

VINTEN, A.
Irrigation Interval as a Factor in Sweet Corn Response to Salinity,
W87-03003 3C

VIRTANEN, M.
Three-dimensional Water-Quality-Transport Model Compared with Field Observations,
W87-02970 2H

VISCHER, D. L.
Rockfall-Induced Waves in Reservoirs,
W87-03037 8E

VONNHAME, D. R.
Use of Climate Predictions to Decide a Water Management Problem,
W87-02633 6A

VOVK, F.
Bloomington Dam, Potomac River Water Quality Outlet,
W87-03231 5G

Water Quality Outlet Warm Springs Dam,
W87-03232 5G

VUORINEN, A.
Environmental Factors Affecting the Acid Neutralization Capacity of Finnish Glacial Till Deposits,
W87-02588 5B

WAINE, J.
Non-Darcian Transmission of Water in Certain Humified Peats,
W87-02846 2G

WAIT, D. A.
Detection of Hepatitis A Virus (HAV) in Drinking Water,
W87-02646 5A

WALKER, D. W.
Rate of Water Loss from Detached Leaves of Drought Resistant and Susceptible Genotypes of Cowpea,
W87-02960 2I

WALL, G. W.
Procedure to Select Drought-Tolerant Sorghum and Millet Genotypes Using Canopy Temperature and Vapor Pressure Deficit,
W87-03001 2I

WALLACE, A.
Effects of Soil Conditioners on Water Relationships in Soils,
W87-02910 2G

WALLACE, G. A.
Effects of Soil Conditioners on Water Relationships in Soils,
W87-02910 2G

WALLACE, I.
Concentrations of 20 Volatile Organic Compounds in the Air and Drinking Water of 350 Residents of New Jersey Compared with Concentrations in Their Exhaled Breath,
W87-02774 5B

WALLBRINK, P. J.
Preferential Flow and Hydraulic Conductivity of Forest Soils,
W87-02724 2G

WALLING, D. E.
Dissolved Loads of Rivers: A Global Overview,
W87-03273 5B

Stream Solute Behaviour in the River Exe Basin, Devon, UK,
W87-03286 5B

WALLIS, J. R.
Value of Historical Data in Flood Frequency Analysis,
W87-03200 2E

WALSKI, T. M.
Assuring Accurate Model Calibration,
W87-02610 5F

WALTER, R.
Interactions between Biotic and Abiotic Factors and Viruses in a Water System,
W87-02657 5B

WALTERS, M.
Morphology of a Saline Groundwater Body: Its Investigation, Description and Possible Explanation,
W87-02849 2F

WALTON, O. E.
Antidegradation Policy for Preserving Surface Water Quality in Florida,
W87-02636 5G

WANG, C.
Upstream Weight Multiple-Cell Balance Finite-Element Method for Solving Three-Dimensional Convection-Dispersion Equations,
W87-03197 2F

WANG, W.
Toxicity Tests of Aquatic Pollutants by Using Common Duckweed,
W87-02582 5A

WANIELISTA, M. P.
Nutrient Transformation in Retention/Detention Ponds Receiving Highway Runoff,
W87-02821 5D

WARBURG, R.
New Strategies for the Isolation of Microorganisms Responsible for Phosphate Accumulation,
W87-02740 5D

WARD, R. L.
Mechanism of Inactivation of Enteric Viruses in Fresh Water,
W87-02893 5B

WARKENTINE, B. E.
Test of a Proposed Organizational Framework for the Ordering of Algal Toxicity Responses,
W87-03205 5C

WARRICK, A. W.
Use of Geostatistics to Predict Virus Decay Rates for Determination of Septic Tank Setback Distances,
W87-02895 5B

WARWICK, J. J.
Diel Variation of In-stream Nitrification,
W87-02711 5B

WATANABE, I.
Effect of Cultivated and Wild Rice Varieties on the Nitrogen Balance of Flooded Soil,
W87-02813 2I

WATANABE, M.
Interaction Between Motile Phytoplankton and Langmuir Circulation,
W87-02969 2L

WATERS, M. R.
Late Quaternary Alluvial Stratigraphy of Whitewater Draw, Arizona: Implications for Regional Correlation of Fluvial Deposits in the American Southwest,
W87-03209 8E

WATSON, C. C.
Fluvial Processes and Morphological Thresholds in Incised Channel Restoration,
W87-02930 2J

WATSON, C. J.
Department of Agriculture, Belfast (N. Ireland). Agricultural and Food Chemistry Research Div.
W87-03159 3F

WATSON, G. D.
Evaporation from the Understorey in the Jarrah (Eucalyptus Marginata Don Ex Sm.) Forest, Southwestern Australia,
W87-02679 2D

WATSON, K. W.
Estimating Macroporosity in a Forest Watershed by use of a Tension Infiltrometer,
W87-02917 2G

WEBB, B. W.
Dissolved Loads of Rivers: A Global Overview,
W87-03273 5B

Stream Solute Behaviour in the River Exe Basin, Devon, UK,
W87-03286 5B

WEBER, G.
Determination of Traces of Tin in Aqueous Matrices by Voltammetry and Atomic Absorption Spectrometry, (Bestimmung von Zinnspuren in wassrigen Matrices mit Voltammetrie und Atomabsorptionsspektrometrie),
W87-02796 5A

WEBER, J. B.
Fluridone Retention and Release in Soils,
W87-02918 5B

WEBSTER, J.
Effects of Sulphide on Survival of Aero-Aquatic and Aquatic Hyphomycetes,
W87-03174 5C

WEED, S. B.
Fluridone Retention and Release in Soils,
W87-02918 5B

WEERASOORIYA, S. V. R.
Chemistry of Tap Water in Sri Lanka - Implications on Health,
W87-03026 5F

Environmental Chemistry of Rainwater in Sri Lanka,
W87-03023 2B

WEIL, R. R.
Salinity Tolerance of Winged Bean as Compared With That of Soybean,
W87-02988 3C

WEKERLE, J.
Virus Inactivating Effect of Anaerobic Mesophilic Digestion of Municipal Sludge With or Without Different Preceding Types of Treatment,
W87-02661 5D

WELLER, J.
Response to Pumping of a Weathered-Fractured Granite Aquifer,
W87-02676 2F

WELLS, J.
New Strategies for the Isolation of Microorganisms Responsible for Phosphate Accumulation,
W87-02740 5D

WENTZEL, M. C.
Kinetics of Biological Phosphorus Release,
W87-02737 5D

WEST, S. D.
Liquid Chromatographic Determination of Fluridone Aquatic Herbicide and Its Metabolite in Fish and Crayfish,
W87-03113 5A

WESTALL, J.
Sorption of Hydrophobic Trace Organic Compounds in Groundwater Systems,
W87-02730 5B

WESTCOTT, M. P.
Comparison of Sprinkler and Flood Irrigation for Rice,
W87-03004 3F

WESTER, D. B.
Effects of Pattern and Amount of Simulated Rainfall on Seedling Dynamics of Weeping Lovegrass and Kleingrass,
W87-03011 2I

WESTERGAARD, B.
Validation of a Prognosis Based Upon a Eutrophication Model,
W87-02602 5C

WESTERLUND, S. F. G.
Benthic Fluxes of Cadmium, Copper, Nickel, Zinc and Lead in the Coastal Environment,
W87-03144 5B

WETZEL, R.
In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-02754 5G

WHITEHEAD, P.
Modelling the Effects of Acidic Deposition And Conifer Afforestation on Stream Acidity in the British Uplands,
W87-03068 5C

WHITEHEAD, P. G.
Modelling the Effects of Hydrological Changes on Stream Water Acidity,
W87-02684 2E

Preliminary Model of Long-Term Changes in Stream Acidity in Southwestern Scotland,
W87-02682 5G

WHITICAR, M. J.
Biogenic Methane Formation in Marine and Freshwater Environments: CO2 Reduction vs. Acetate Fermentation-Isotope Evidence,
W87-03137 5B

WIERENGA, P. J.
Observations of Spatial Variability of Soil-Water Pressure in a Field Soil,
W87-02713 2G

WILCOX, C. J.
Interim Progress Report, Volume I: SCPP Meteorological and Statistical Support for Period 1 September 1984 through 31 August 1985,
W87-03327 2B

WILHELMS, S. C.
Operational Tools: Optimal Control of Reservoir Water Quality,
W87-03239 5G

Operational Tools: Selective Withdrawal and Daily Operational Strategy,
W87-03238 5G

SELECT: The Numerical Model,
W87-03235 5G

Selective Withdrawal: Basic Concepts,
W87-03222 8B

WILHITE, D. A.
Drought Policy in the U.S. and Australia: A Comparative Analysis,
W87-02937 6E

WILLIAMS, A. G.
Stream Solute Sources and Variations in a Temperate Granite Drainage Basin,
W87-03296 5B

WILLIAMS, D. T.
Halogenated Phenols in Water at Forty Canadian Potable Water Treatment Facilities,
W87-03112 5F

WILLIAMS, F. P.
Waterborne Viral Gastroenteritis,
W87-02612 5C

WILLIAMS, G. H.
Nonpoint Source Loading of Phenolic Acids from Decomposing Crop Residue,
W87-03161 5B

WILLIAMS, R.
Evaporation Data from a Capillary Evaporimeter,
W87-03073 7B

WILLIAMSON, C. H. K.
Evolution of a Single Wake Behind a Pair of Bluff Bodies,
W87-02862 2E

WINDOLF-NIELSEN, J.
Validation of a Prognosis Based Upon a Eutrophication Model,
W87-02602 5C

WINSTON, P. E.
Mechanism of Inactivation of Enteric Viruses in Fresh Water,
W87-02893 5B

WINTERSTEIN, T.
Passive Screen Water Intake Design Studies,
W87-02767 8I

WITTER, K. A.
Termination Criteria for Clay Permeability Testing,
W87-02788 2G

WOFSY, S. C.
Chemical Control of Soluble Phosphorus in the Amazon Estuary,
W87-03139 5B

WOLMAN, A.
Planning and Technology in Sanitary and Environmental Engineering,
W87-03098 6A

WONG, K. F. V.
Field Validation of the Contaminant Transport Model, FEMA,
W87-03089 5B

WOOD, E. F.
Hydrologic Similarity: 1. Derivation of the Dimensionless Flood Frequency Curve,
W87-03194 2E

WOOLHOUSE, H. W.
Alcohol Dehydrogenase Activity in the Roots of Marsh Plants in Naturally Waterlogged Soils,
W87-02816 2I

WOSTEN, J. H. M.
Procedure to Identify Different Groups of Hydraulic-Conductivity and Moisture-Retention Curves for Soil Horizons,
W87-03075 2G

WRIGHT, K. D.
Evaporation from the Understorey in the Jarrah (Eucalyptus Marginata Don Ex Sm.) Forest, Southwestern Australia,
W87-02679 2D

WRIGHT, R. M.
Macrophyte Growth in Shallow Streams: Biomass Model,
W87-02888 5C

Macrophyte Growth in Shallow Streams: Field Investigations,
W87-02887 5C

WU, L.
Contrasting Response to Salt Stress of Two Salinity Tolerant Creeping Bentgrass Clones,
W87-03156 5C

WYLER, R.
Method for Determining Virus Inactivation During Sludge Treatment Processes,
W87-02898 5A

WYMAN, M.
Underwater Light Climate and the Growth and Pigmentation of Planktonic Blue-Green Algae (Cyanobacteria) I. The Influence of light quantity,
W87-02908 2H

Underwater Light Climate and the Growth and Pigmentation of Planktonic Blue-green Algae (Cyanobacteria) II. the Influence of Light Quality,
W87-02909 2H

WYNESS, L. E.
Water or Salt Stress Increases Infectivity of Erysiphe pisi Conidia Taken from Stressed Plants,
W87-03175 5C

YAMADA, M.
Selective Preconcentration of Copper from Aqueous Solution by Using Kerateine Gel,
W87-02802 5A

YANG, J.
Effects of Chloroform Toxicity on Methane Fermentation,
W87-02704 5D

YATES, M. V.
Use of Geostatistics to Predict Virus Decay Rates for Determination of Septic Tank Setback Distances,
W87-02895 5B

YATES, S. R.
Use of Geostatistics to Predict Virus Decay Rates for Determination of Septic Tank Setback Distances,
W87-02895 5B

YEH, G. T.
Field Validation of the Contaminant Transport Model, FEMA,
W87-03089 5B

YEH, T.-C. J.
Observations of Spatial Variability of Soil-Water Pressure in a Field Soil,
W87-02713 2G

YEH, W. W. G.
Upstream Weight Multiple-Cell Balance Finite-Element Method for Solving Three-Dimensional Convection-Dispersion Equations,
W87-03197 2F

YIGIT, V.
Determination of Pollution and Eutrophic Conditions of Sapanca Lake (Turkey),
W87-02587 5B

YOSHIDA, M.
Remote Sensing Techniques for Assessing Water Deficits and Modeling Crop Response,
W87-02953 7B

YOSHIDA, T.
In Situ Stream Water Clarifying Tests,
W87-03265 5G

YOSHINO, Z.
Dewatering of Bottom Sediments,
W87-03261 2J

YOUNG, C. E.
Impacts of Water Quality Improvement on Site Visitation: A Probabilistic Modeling Approach,
W87-02622 4D

YOUSEF, Y. A.
Nutrient Transformation in Retention/Detention Ponds Receiving Highway Runoff,
W87-02821 5D

YUEN, E. M.
Erosion of Unconsolidated Gravel Beds,
W87-02673 2J

YURKEVICH, B. N.
Experience of Using the Turbine-Generator Units of the Kolyma Hydroelectric Station for Idle Discharge of Water,
W87-03177 8C

ZAKI, M. H.
Groundwater Contamination with Synthetic Organic Compounds and Pesticides in Suffolk County,
W87-02827 5B

ZDANOWICZ, V. S.
Organic and Trace Metal Levels in Ocean Quahog, Arctica islandica Linne, from the Northwestern Atlantic,
W87-02759 5B

ZELON, H.
Concentrations of 20 Volatile Organic Compounds in the Air and Drinking Water of 350 Residents of New Jersey Compared with Concentrations in Their Exhaled Breath,
W87-02774 5B

ZEMEL, A.
Infiltration and Water Extraction from Trickle Irrigation Source: The Effective Hemisphere Model,
W87-02725 2G

ZENTNER, R. P.
Snow and Fertilizer Management for Continuous Zero-Till Spring Wheat,
W87-02879 3F

ZHAU, D.
Performance of China's First Concrete Cut-off Wall,
W87-02689 8A

ZHONG, C. G.
Waterhammer Pressure Compensation in Turbine Regulating Systems,
W87-02690 8C

ZHU, L.-Z.
Spectrophotometric Determination of Chromium in Waste Water and Soil,
W87-03052 5A

ZIERATH, R.
Composition of Precipitation Water and Its Acidity,
W87-02721 5B

ZUBER, A.
Interpretation of Tracer Data in Variable Flow Systems,
W87-03070 7B

ZUR, B.
Interactive Effects of Nitrogen and Water Stresses on Water Relations of Field-Grown Corn Leaves,
W87-02994 2I

ZUURING, H. R.
Watershed Modeling for Fire Management Planning in the Northern Rocky Mountains,
W87-03323 4D

ORGANIZATIONAL INDEX

AGENCE DE BASSIN LOIRE-BRETAGNE, ORLEANS (FRANCE).
Problem of Phosphorus in France - Its Presence in Natural Waters and Biological Phosphorus Removal,
W87-02734 5G

AGRICULTURAL RESEARCH AND EDUCATION CENTER, LAKE ALFRED, FL.
Integration of Water Stress in Fruit Trees,
W87-02952 2I

Nitrogen Source and Application Timing for Trickle Irrigated Strawberries,
W87-03109 3F

AGRICULTURAL RESEARCH INST., NICOSIA (CYPRUS). SOILS AND WATER USE SECTION.
Effect of High Sulfate Irrigation Waters on Soil Salinity and Yields,
W87-02996 3C

AGRICULTURAL RESEARCH INST. OF NORTHERN IRELAND, HILLSBOROUGH.
Evaluation of Effluent from Grass Silage as a Feed for Beef Cattle Offered Silage-based Diets,
W87-03099 5E

AGRICULTURAL RESEARCH SERVICE, BRAWLEY, CA. IRRIGATED DESERT RESEARCH STATION.
Polyacrylamide Application in Irrigation Water to Increase Infiltration,
W87-02911 2G

AGRICULTURAL RESEARCH SERVICE, BUSHLAND, TX.
Management of Sorghum Under Limited Irrigation,
W87-02987 3F

AGRICULTURAL RESEARCH SERVICE, BUSHLAND, TX. CONSERVATION AND PRODUCTION LAB.
Profile Modification and Irrigation Effects on Yield and Water Use of Wheat,
W87-02920 3F

Wheat Residue Management Effects on Soil Water Storage and Corn Production,
W87-02924 3F

Dryland Grain Sorghum Water Use, Light Interception, and Growth Response to Planting Geometry,
W87-03008 2I

Response of Conservation Tillage Sorghum to Growing Season Precipitation,
W87-03167 3F

AGRICULTURAL RESEARCH SERVICE, CHARLESTON, S.C. VEGETABLE LAB.
Muskmelon Growth, Yield, and Nutrition as Influenced by Planting Method and Trickle Irrigation,
W87-03108 3F

AGRICULTURAL RESEARCH SERVICE, PHOENIX, AZ. WATER CONSERVATION LAB.
Percolation of Water Below an Irrigated Field,
W87-02722 5B

Transport of Conservative Tracers in the Field Under Intermittent Flood Irrigation,
W87-03191 2G

AGRICULTURAL RESEARCH SERVICE, PHOENIZ, AZ. WESTERN COTTON RESEARCH LAB.
Accumulation and Turnover of Abscisic Acid in Osmotically Stressed Cotton Leaf Tissue in Relation to Temperature,
W87-03216 2I

AGRICULTURAL RESEARCH SERVICE, PROSSER, WA. IRRIGATED AGRICULTURE RESEARCH AND EXTENSION CENTER.
Root Systems in Relation to Stress Tolerance,
W87-02961 2I

AGRICULTURAL RESEARCH SERVICE, PULLMAN, WA.
Estimating Generalized Soil-water Characteristics from Texture,
W87-02727 2G

AGRICULTURAL RESEARCH SERVICE, RIVERSIDE, CA. SALINITY LAB.
Root Control of Leaf Phosphorus and Chlorine Accumulation in Soybean Under Salinity Stress,
W87-02984 2I

AGRICULTURAL UNIV., WAGENINGEN (NETHERLANDS). DEPT. OF MICROBIOLOGY.
Some Physiological Characteristics of Acinetobacter spp. Accumulating Large Amounts of Phosphate,
W87-02742 5D

AGRICULTURAL UNIV., WAGENINGEN (NETHERLANDS). DEPT. OF PHYSICS AND METEOROLOGY.
Evaporation Data from a Capillary Evaporimeter,
W87-03073 7B

AGRICULTURAL UNIV., WAGENINGEN (NETHERLANDS). DEPT. OF SOIL SCIENCE AND GEOLOGY.
Transport of Solutes in Soil: Basic Features of Front Retardation,
W87-02733 5B

AGRICULTURAL UNIV., WAGENINGEN (NETHERLANDS). DEPT. OF WATER POLLUTION CONTROL.
Phosphorus Removal at Low Sludge Loadings,
W87-02747 5D

AGRICULTURE AND FOOD SCIENCE CENTRE, BELFAST (NORTHERN IRELAND). AGRICULTURAL AND FOOD CHEMISTRY RESEARCH DIV.
Department of Agriculture, Belfast (N. Ireland). Agricultural and Food Chemistry Research Div.
W87-03159 3F

AIR FORCE ENGINEERING AND SERVICES CENTER, TYNDALL AFB, FL.
In Situ Aerobic Biodegradation of Aquifer Contaminants at Kelly Air Force Base,
W87-02754 5G

AIX-MARSEILLE-1 UNIV. (FRANCE).
Metabolical Activity of Bacteria in Geothermal Spring-waters Dating from Dogger and Trias Periods in the Bassin Parisien, (Activites Metaboliques des Bacteries des Eaux Geothermales du Dogger et du Trias du Bassin Parisien),
W87-02562 5B

AKADEMIA ROLNICZA, WROCLAW (POLAND). DEPT. OF MATHEMATICS.
Analytical and Numerical Solution of Saint-Venant Equations,
W87-03067 2E

AKADEMIE DER WISSENSCHAFTEN DER DDR, BERLIN. INST. FUER GEOGRAPHIE UND GEOOEKOLOGIE.
Composition of Precipitation Water and Its Acidity,
W87-02721 5B

ALABAMA AGRICULTURAL EXPERIMENT STATION, AUBURN.
Distribution of Dry Matter Between Shoots and Roots of Irrigated and Nonirrigated Determinate Soybeans,
W87-03010 2I

Effects of In-Row and Interrow Subsoiling and Time of Nitrogen Application on Growth, Stomatal Conductance and Yield of Strip-Tilled Corn,
W87-03170 3F

ALASKA DEPT. OF FISH AND GAME, ANCHORAGE.
Review and Analysis of Methods for Quantifying Instream Flow Requirements,
W87-02933 6D

ALBERTA UNIV., EDMONTON. DEPT. OF CIVIL ENGINEERING.
Snow Loads in the 1985 National Building Code of Canada: Curved Roofs,
W87-02667 2C

ALBERTA UNIV., EDMONTON. DEPT. OF MICROBIOLOGY.
Effects of Cyanide on the Methanogenic Degradation of Phenolic Compounds,
W87-02709 5D

ALL-UNION SCIENTIFIC RESEARCH INST. OF GAME MANAGEMENT AND FUR BREEDING, VOLGA (USSR).
Classification of Macrophytes in Bodies of Water and of Aquatic Vegetation,
W87-02772 2H

ALUMINUM CO. OF AMERICA, ALCOA CENTER, PA. ALCOA LABS.
Application of Aluminas in Water Treatment,
W87-02752 5D

AMERICAN UNIV., BEIRUT (LEBANON).
Soil Application of a Hydrophilic Conditioner in Relation to Moisture, Irrigation Frequency and Crop Growth,
W87-02881 3F

AMERICAN UNIV., BEIRUT (LEBANON). FACULTY OF ENGINEERING AND ARCHITECTURE.
Seawater Induced Algal Flocculation,
W87-02703 5D

AMERICAN WATER RESOURCES ASSOCIATION, BETHESDA, MD.
National Water Policy -- Does Anybody Want One,
W87-02619 6E

ANAMBRA STATE UNIV. OF TECHNOLOGY, ENUGU (NIGERIA). DEPT. OF GEOLOGICAL SCIENCES.
Comparative Analysis of Transmissivity and Hydraulic Conductivity Values from the Ajali Aquifer System of Nigeria,
W87-02859 2F

ANTWERP UNIV., WILRIJK (BELGIUM). DEPT. OF BIOLOGY.
Effect of Short-term Water Stress on Leaf Gas Exchange Processes and Plant Water Potential in Schefflera,
W87-03104 2I

AQUAGENE TECH CORP., SAN DIEGO, CA.
Phosphorus Uptake by Klebsiella pneumoniae and Acinetobacter calcoaceticus,
W87-02741 5D

ARATEX SERVICES, INC., ENCINO, CA.
Development of a Combined Ultrafiltration and Carbon Adsorption System for Industrial Wastewater Reuse and Priority Pollutant Removal,
W87-02753 5D

ARGONNE NATIONAL LAB., IL. CHEMICAL TECHNOLOGY DIV.
Adsorption of Select Phenol Derivatives by Dolomite,
W87-02583 5B

ARIZONA STATE MUSEUM, TUCSON. CULTURAL RESOURCE MANAGEMENT DIV.
Research Design for Tucson Aqueduct, Phase B Data Recovery,
W87-03328 6G

Supplemental Class III Archaeological Survey of the Phase A, Reach 3 Corridor, Tucson Aqueduct, Central Arizona Project: Late Sedentary and Early Classic Period Tucson Basin Hohokam Occupation in the Lower Santa Cruz Basin, Marana to Rillito, Arizona,
W87-03329 6G

ARIZONA UNIV., TUCSON.
Drought Avoidance in Tall Fescue,
W87-03019 2I

ARIZONA UNIV., TUCSON. DEPT. OF HYDROLOGY AND WATER RESOURCES.
Observations of Spatial Variability of Soil-Water Pressure in a Field Soil,
W87-02713 2G

ARIZONA UNIV., TUCSON. DEPT. OF MICROBIOLOGY AND IMMUNOLOGY.
Use of Geostatistics to Predict Virus Decay Rates for Determination of Septic Tank Setback Distances,
W87-02895 5B

Microbial Aspects of Wastewater Reuse for Irrigation,
W87-03129 3C

ARIZONA UNIV., TUCSON. DEPT. OF SOILS, WATER AND ENGINEERING.
Ammonium (15N) Metabolism in Cotton Under Salt Stress,
W87-03151 5C

ARIZONA UNIV., TUCSON. EVAPOTRANSPIRATION LAB.
Procedure to Select Drought-Tolerant Sorghum and Millet Genotypes Using Canopy Temperature and Vapor Pressure Deficit,
W87-03001 2I

ARKANSAS UNIV., FAYETTEVILLE. DEPT. OF AGRONOMY.
Herbicides and Seeding Rate Effects on Sprinkler-Irrigated Rice,
W87-03013 2I

ARMY ENGINEER DISTRICT, FORT WORTH, TX.
Review of Selective Withdrawal Performance in the Fort Worth District,
W87-03229 6B

Modeling of Selective Withdrawal Intake Structures,
W87-03230 5G

ARMY ENGINEER DISTRICT, LITTLE ROCK, AR.
Alternatives for Improving Reservoir Water Quality,
W87-03228 5G

ARMY ENGINEER DISTRICT, PITTSBURGH, PA.
Overview of Pittsburgh District Selective Withdrawal Operation Experiences,
W87-03244 5G

Selective Withdrawal From Any Level Between Minimum Pool and Spillway Elevation at Stonewall Jackson Dam, West Virginia,
W87-03245 8A

ARMY ENGINEER DISTRICT, PORTLAND, OR.
Hydraulic Design of the Selective Withdrawal Structures of the Lost Creek Dam,
W87-03223 8A

Hydraulic Design of the Selective Withdrawal Structures of the Applegate Dam,
W87-03224 8A

Hydraulic Design of the Selective Withdrawal Structures at the Elk Creek Dam,
W87-03225 8A

Reservoir Regulation and Selective Withdrawal in Oregon,
W87-03226 6D

Selection and Management of a New Orlean Dredged Material Disposal Site at Coos Bay, Oregon, USA, to Receive Contaminated Dredged Material,
W87-03263 5E

ARMY ENGINEER DIV. OHIO RIVER, CINCINNATI.
Selective Withdrawal Structure Operation Experiences in ORD,
W87-03243 8A

ARMY ENGINEER INST. FOR WATER RESOURCES, FORT BELVOIR, VA.
Management of Bottom Sediments Containing Toxic Substances.
W87-03248 5G

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS.
Historic Trends in the Sediment Flow Regime of the Mississippi River,
W87-03195 2J

Field Measurements at Intake Structures,
W87-03240 8B

Selective Withdrawal Needs for Lake Greeson Arkansas Intake Structure,
W87-03242 5G

Environmental and Water Quality Operational Studies (EWQOS) - Application to Lake Restoration,
W87-03271 5G

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS. ENVIRONMENTAL EFFECTS LAB.
Environmental Designs for Streambank Protection Projects,
W87-02621 6G

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS. ENVIRONMENTAL LAB.
Identification of Promising Concepts for Treatment of Contaminated Sediments,
W87-03256 5D

Feasibility of Using Mycorrhizal Fungi for Enhancement of Plant Establishment on Dredged Material Disposal Sites: A Literature Review,
W87-03316 3D

Statistical Methods for Reservoir Water Quality Investigations,
W87-03322 7C

Effectiveness of Capping in Isolating Dutch Kills Sediment from Biota and the Overlying Water,
W87-03332 5G

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS. HYDRAULICS LAB.
Proceedings: CE Workshop on Design and Operation of Selective Withdrawal Intake Structures.
W87-03221 8A

Selective Withdrawal: Basic Concepts,
W87-03222 8B

SELECT: The Numerical Model,
W87-03235 5G

Blending in a Single Wet Well,
W87-03236 5G

Design of Selective Withdrawal Intake Structures,
W87-03237 8A

Operational Tools: Selective Withdrawal and Daily Operational Strategy,
W87-03238 5G

Operational Tools: Optimal Control of Reservoir Water Quality,
W87-03239 5G

Riprap Stability and Navigation Tests for the Divide-Cut Section Tennessee-Tombigbee Waterway,
W87-03317 8A

Lock and Dam 1, Red River Waterway: Hydraulic Model Investigation,
W87-03333 8B

Burlington Spillway and Outlet Works Souris River, North Dakota: Hydraulic Model Investigation,
W87-03334 8B

Mill Creek Channel, Walla Walla, Washington: Hydraulic Model Investigation,
W87-03335 8B

ARMY ENGINEER WATERWAYS EXPERIMENT STATION, VICKSBURG, MS. STRUCTURES LAB.
Latex Admixtures for Portland Cement Concrete and Mortar,
W87-03318 8G

ATELIERS DE CONSTRUCTIONS ELECTRIQUES DE CHARLEROI (BELGIUM).
Data Processing for Hydro Plant Control,
W87-03033 8C

ATHENS UNIV. (GREECE). INST. OF INORGANIC AND ANALYTICAL CHEMISTRY.
Investigations on the Application of the Ion-Exchanger SRAFION NMRR for the Enrichment and Separation of Uranium and Other Trace Elements from Sea Water, (Untersuchungen uber die Verwendbarkeit des Ionenaustauschers SRAFION NMRR zur Anreicherung und Abtrennung von Uran und anderen Spurenelementen aus dem Meerwasser),
W87-02803 5A

AUBURN UNIV., AL. DEPT. OF AGRONOMY AND SOILS.
Combined Effect of Hysteresis and Temperature on Soil-Water Movement,
W87-02857 2G

Temperature Dependence of Soil Water Retention Curves,
W87-02914 2G

AUBURN UNIV., AL. DEPT. OF CIVIL ENGINEERING.
Deterministic and Stochastic Analyses of Dispersion in an Unbounded Stratified Porous Medium,
W87-03196 5B

AUBURN UNIV., AL. DEPT. OF HORTICULTURE.
Irrigation Scheduling Effects on Container Media and Canopy Temperatures and Growth of 'Hershey's Red' Azalea,
W87-03103 3F

AUCKLAND UNIV. (NEW ZEALAND). DEPT. OF PHYSICS.
Measurements of pH versus Drop Size in Natural Rain,
W87-02811 2B

AVON DEPT. OF HEALTH, CT.
Lead Dissolution From Soldered Joints,
W87-02607 5B

AZABU UNIV., SAGAMIHARA (JAPAN). FACULTY OF GENERAL EDUCATION.
Contaminating Peptides Widely Present in Ion-Exchanged Water, Reagents, Experimental Implements and Natural Sample,
W87-02787 5B

BATH UNIV. (ENGLAND). SCHOOL OF BIOLOGICAL SCIENCES.
Seasonal Abundance, Growth, Feeding and Age Composition of Flounder (Platichthys flesus (L.)) Populations of the Severn Estuary and Bristol Channel,
W87-03027 2L

BATTELLE PACIFIC NORTHWEST LABS., RICHLAND, WA.
Air Encapsulation: I. Measurement in a Field Soil,
W87-02915 2G

Air Encapsulation: II. Profile Water Storage and Shallow Water Table Fluctuations,
W87-02916 2F

BAYLOR COLL. OF MEDICINE, HOUSTON, TX. DEPT. OF VIROLOGY AND EPIDEMIOLOGY.
Human Viruses in Sediments, Sludges, and Soils,
W87-02768 5B

Development of a Method for Concentration of Rotavirus and Its Application to Recovery of Rotaviruses from Estuarine Waters,
W87-02896 5A

BELGRADE UNIV. (YUGOSLAVIA). FACULTY OF AGRICULTURE.
Regime of Ground Water of Semberian Aquifer,
W87-03043 2F

BEN-GURION UNIV. OF THE NEGEV, BEERSHEBA (ISRAEL). DEPT. OF BIOLOGY.
Decline of the Gastropod Nucella lapillus Around South-West England: Evidence for the Effect of Tributyltin from Antifouling Paints,
W87-03053 5C

Potassium Utilization and Fluxes in Wild Salt-Tolerant Relatives of the Cultivated Tomato,
W87-03055 2I

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Infiltration and Water Extraction from Trickle Irrigation Source: The Effective Hemisphere Model,
W87-02725 2G

Trickle Irrigation of Wheat Applying Renovated Wastewater,
W87-02938 3F

BENIN UNIV., BENIN CITY (NIGERIA). DEPT. OF CHEMISTRY.
Insecticides and Metals in Nigerian Surface Water - Warri River,
W87-03028 5B

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Vegetation of the Low-Shrub Bogs of Northern New Jersey and Adjacent New York: Ecosystems at their Southern Limit,
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Study of Acid Deposition in Switzerland: Temporal Variation in the Ionic Composition of Wet Precipitation at Rural Sites During 1983-1984,
W87-02763 5B

BHAVNAGAR UNIV. (INDIA). DEPT. OF LIFE SCIENCES.
Effects of Seawater on Amino Acids and Mineral Ions Composition in Salicornia brachiata Roxb,
W87-03093 3C

BIRMINGHAM UNIV. (ENGLAND). DEPT. OF CIVIL ENGINEERING.
Response to Pumping of a Weathered-Fractured Granite Aquifer,
W87-02676 2F

Ion-Exchange Resin Samplers for the In-Site Measurement of Major Cations in Soilwater Solute Flux,
W87-02678 7B

BIRMINGHAM UNIV. (ENGLAND). DEPT. OF GEOLOGICAL SCIENCES.
Examination of the Mechanisms Controlling Groundwater Gradients in Hyper-Arid Regional Sedimentary Basins,
W87-02942 2F

BIRMINGHAM UNIV. (ENGLAND). HYDROGEOLOGY SECTION.
Morphology of a Saline Groundwater Body: Its Investigation, Description and Possible Explanation,
W87-02849 2F

BLACK AND VEATCH, KANSAS CITY, MO.
Long Distqance Water Rights,
W87-02637 6E

BONN UNIV. (GERMANY, F.R.). HYGIENE INST.
Drinking Water Materials: Field Observations and Methods of Investigation,
W87-03340 5F

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Analysis of Earth-Tide-Induced Groundwater Flow in Eastern Botswana,
W87-02840 2F

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Effect of Cultivated and Wild Rice Varieties on the Nitrogen Balance of Flooded Soil,
W87-02813 2I

BRANDEIS UNIV., WALTHAM, MA. ROSENSTIEL BASIC MEDICAL SCIENCES RESEARCH CENTER.
New Strategies for the Isolation of Microorganisms Responsible for Phosphate Accumulation,
W87-02740 5D

BRAZOS RIVER AUTHORITY, WACO, TX.
Evaluation of Weekly and Monthly Time Series Forecasts of Municipal Water Use,
W87-02629 6A

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY, VANCOUVER. HYDROELECTRIC GENERATION PROJECTS DIV.
65 MW Bulb Turbine for Japan's Tadami Project,
W87-02691 8C

BRITISH COLUMBIA HYDRO AND POWER AUTHORITY, VANCOUVER. METALLURGY SECTION.
Materials Technology for Turbine Performance,
W87-02687 8C

BRITISH COLUMBIA MINISTRY OF ENVIRONMENT, VICTORIA.
Effect of Soil and Effluent Characteristics on Phosphorus Sorption in Dosed Columns,
W87-02861 2G

BRITISH COLUMBIA UNIV., VANCOUVER. DEPT. OF CIVIL ENGINEERING.
Recent Advances in the Computation of Nonlinear Wave Effects on Offshore Structures,
W87-02668 8B

BRITISH GEOLOGICAL SURVEY, WALLINGFORD (ENGLAND).
New Analogue Computer for the Study of Pumping Tests under Falling Water-Table Conditions,
W87-02854 7B

BROOKLYN COLL., NY. DEPT. OF GEOLOGY.
Medical Geology,
W87-02825 5C

BROWN AND CALDWELL, PLEASANT HILL, CA.
Finding Uses for Sludge,
W87-02641 5E

Biological Phosphorus Removal: A Technology Evaluation,
W87-02820 5D

BROWN UNIV., PROVIDENCE, RI. GRADUATE PROGRAM IN ECOLOGY AND EVOLUTIONARY BIOLOGY.
Survivorship and Spatial Development of Spartina alterniflora Loisel. (Gramineae) Seedlings in a New England Salt Marsh,
W87-03096 2L

BUNDESANSTALT FUER GEOWISSENSCHAFTEN UND ROHSTOFFE, HANOVER (GERMANY, F.R.).
Biogenic Methane Formation in Marine and Freshwater Environments: CO2 Reduction vs. Acetate Fermentation-Isotope Evidence,
W87-03137 5B

BUNDESFORSCHUNGSANSTALT FUER FISCHEREI, HAMBURG (GERMANY, F.R.).
Possibilities of Improving the Determination of Extremely Low Lead Concentrations in Marine Fish by Graphite Furnace Atomic Absorption Spectrometry,
W87-02794 5A

BUREAU DE RECHERCHES GEOLOGIQUES ET MINIERES, ORLEANS (FRANCE). INST. MIXTE DE RECHERCHES GEOTHERMIQUES.
Study of Foamy Thermomineral Water of French Massif Central. I. Oxidation-reduction Potential and Behavior of Iron (Etude des eaux Thermominearales Carbogazeuses du Massif Central Francais. I. Potentiel d'Oxydo-Reduction et Comportement du Fer),
W87-03134 5B

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W87-03146 2K

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Management of Instream Flows through Runoff Detention and Retention,
W87-02934 4A

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Legal System and Works for Preservation of the Port, Harbour, and Marine Environment in Japan,
W87-03249 5G

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Alkali-Silica Reactivity in Five Dams in Southwestern United States,
W87-03319 8F

Tunnels: Machine Excavation - Rate of Progress - Machine Data,
W87-03320 8A

Primary Productivity (C14) at Twin Lakes Colorado: 1973-81 Study Results,
W87-03326 2H

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Chubb/Bauman Method for Estimating the Recreation Potential of Rivers: A Critical Review,
W87-02634 6A

Plains Cottonwood Recruitment and Survival on a Prairie Meandering River Floodplain, Milk River, Southern Alberta and Northern Montana,
W87-02769 2I

CALIFORNIA STATE DEPT. OF WATER RESOURCES, SACRAMENTO.

Models for Water and Power Scheduling for the California State Water Project,
W87-02626 6A

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Modeling of Pollutant Dispersion in Stratified Oscillatory Flows,
W87-02885 5B

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Water Conservation and Recycling in Ornamentals Production,
W87-02957 3F

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Distribution of Economic Rents Arising from Subsidized Water When Land is Leased,
W87-02874 6C

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Contrasting Response to Salt Stress of Two Salinity Tolerant Creeping Bentgrass Clones,
W87-03156 5C

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Hydrogen Isotope Study of Large-Scale Meteoric Water Transport in Northern California and Nevada,
W87-02686 2F

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Responses of Lettuce to Salinity. I. Effects of NaCl and Na2SO4 on Growth,
W87-03154 5C

Salt Responses of Lettuce to Salinity. II. Effect of Calcium on Growth and Mineral Status,
W87-03155 5C

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Patterns in Distribution and Abundance of a Noncoevolved Assemblage of Estuarine Fishes in California,
W87-02758 2L

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Upstream Weight Multiple-Cell Balance Finite-Element Method for Solving Three-Dimensional Convection-Dispersion Equations,
W87-03197 2F

CALIFORNIA UNIV., LOS ANGELES. LAB. OF BIOMEDICAL AND ENVIRONMENTAL SCIENCES.

Effects of Soil Conditioners on Water Relationships in Soils,
W87-02910 2G

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Production Function for Cotton with Dated Irrigation Quantities and Qualities,
W87-03189 3F

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Evolution of a Single Wake Behind a Pair of Bluff Bodies,
W87-02862 2E

CAMP, DRESSER AND MCKEE, INC., BOSTON, MA.

Containing Landfill Leaks,
W87-02639 5B

Safe Drinking Water Act,
W87-03122 6E

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Chione (Austrovenus) stutchburyi, a New Zealand Cockle, as a Bio-indicator for Lead Pollution,
W87-02586 5A

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Kinetics of Biological Phosphorus Release,
W87-02737 5D

CAPE TOWN UNIV. (SOUTH AFRICA). DEPT. OF MEDICAL MICROBIOLOGY.

Genomic Analysis of RNA Viruses Isolated from Water,
W87-02645 5A

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Groundwater Seepage Vectors and the Potential for Hillslope Failure and Debris Flow Mobilization,
W87-03193 2F

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Prevention and Treatment of Endemic Iodine-Deficiency Goiter by Iodination of a Municipal Water Supply,
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Evaporation and Redistribution of Salts in a Silt Loam Soil as Affected by Tillage Induced Soil Mulch,
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Anaerobic Treatment of Coke Plant Waste Water,
W87-02783 5D

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Polyphosphate Kinase Activity during Phosphate Uptake by Bacteria,
W87-02736 5D

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Spectral and Statistical Characteristics of Shallow Water Waves,
W87-03218 8B

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Different Techniques for the Computation of River Nutrient Loads (Methodologies de Quantification des Flux de Nutriments en Riviere),
W87-03298 2H

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W87-02611 5F

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Effect of Oxygen on Release and Uptake of Cobalt, Manganese, Iron and Phosphate at the Sediment-Water Interface,
W87-03143 5B

Benthic Fluxes of Cadmium, Copper, Nickel, Zinc and Lead in the Coastal Environment,
W87-03144 5B

CHARLESTON COLL., SC.
Anomalous Natural Sulfate in Water Wells of the Greenbrier Group, West Virginia,
W87-02625 5B

CHEMICAL RESEARCH, DEVELOPMENT AND ENGINEERING CENTER, ABERDEEN PROVING GROUND, MD.
Toxicity of Brass Dust to the Microalgae Ankistrodesmus falcatus and Selenastrum capricornutum,
W87-02778 5C

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Nutrient and Trace Metal Fluxes in the Magela Creek System, Northern Australia,
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Exposure to Fluoridated Public Water Supplies and Child Health and Behaviour,
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Preservation of Traces of Chromium(VI) in Water and Waste Water Samples,
W87-02804 5A

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Establishing a Stormwater Management Utility,
W87-03123 2E

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Computation of Wave Transmission Over a Shore Protecting Submerged Breakwater,
W87-03217 8B

COLORADO DIV. OF WILDLIFE, FORT COLLINS.
Tenmile Creek: A study of Stream Relocation,
W87-02935 4A

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRICULTURAL AND CHEMICAL ENGINEERING.
Ecological Modelling, Monitoring and Implementation in Irrigated Agriculture,
W87-02966 3F

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF EARTH RESOURCES.
Fluvial Processes and Morphological Thresholds in Incised Channel Restoration,
W87-02930 2J

COLORADO STATE UNIV., GRAND JUNCTION. FRUITA RESEARCH CENTER.
Irrigation Effects on Agronomic Characters of Meadowfoam,
W87-02995 3F

COLUMBIA NATIONAL FISHERIES RESEARCH LAB., MO.
Effects of Four Agricultural Pesticides on Daphnia pulex, Lemna minor, and Potamogeton pectinatus,
W87-02589 5C

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Preferential Flow and Hydraulic Conductivity of Forest Soils,
W87-02724 2G

Kinematic Overland Flow: Generalization of Rose's Approximate Solution,
W87-02841 2E

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Water Use in Urban Korea,
W87-02617 6D

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Evaporation from the Understorey in the Jarrah (Eucalyptus Marginata Don Ex Sm.) Forest, Southwestern Australia,
W87-02679 2D

COMPAGNIE NATIONALE DU RHONE, LYON (FRANCE).
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W87-02575 8C

CONGRESSIONAL BUDGET OFFICE, WASHINGTON, DC. NATURAL RESOURCES AND COMMERCE DIV.
Emerging Trends in Infrastructure Financing,
W87-02606 6C

CONNECTICUT UNIV., GROTON. MARINE SCIENCES INST.
Evaluation of the Factors Governing the Mobility of Dredged Material Placed at Open Water Disposal Sites,
W87-03252 5E

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Wastewater Engineering Design for Unsewered Areas,
W87-03339 5E

COOK COLL., NEW BRUNSWICK, NJ. DEPT. OF BIOCHEMISTRY AND MICROBIOLOGY.
Control of the Methylation Process in a Mercury-polluted Aquatic Sediment,
W87-02584 5B

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Dissolved and Particulate Load in Danish Water Courses,
W87-03293 5B

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Indirect Atomic Absorption Determination of Anionic Surfactants in Wastewaters by Flow Injection Continuous Liquid-Liquid Extraction,
W87-03048 5A

CORNELL UNIV., ITHACA, NY.
Impact of Chemically Contaminated Sewage Sludge on the Collard Arthropod Community,
W87-03081 5C

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Ecology and Estuarine Impact Assessment: Lessons Learned from the Hudson River (U.S.A.) and Other Estuarine Experiences,
W87-02776 2L

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Hydraulic Design: Bloomington Lake and F. E. Walter Dam Project's Selective Withdrawal Structures,
W87-03233 8A

Determination of Selective Withdrawal System Capacity for Intake Tower Design,
W87-03234 5G

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W87-03246 6B

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Design and Performance of Skimming Weirs in the Kansas City District,
W87-03247 8A

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Characterization of Sediment Contamination Utilizing Bioassay/Biaccumulation Testing,
W87-03255 5B

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Bloomington Dam, Potomac River Water Quality Outlet,
W87-03231 5G

Water Quality Outlet Warm Springs Dam,
W87-03232 5G

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Operation of Selective Withdrawal Facilities: Libby Dam, Montana,
W87-03227 5C

CORPS OF ENGINEERS, VICKSBURG, MS.
Assuring Accurate Model Calibration,
W87-02610 5F

CORPS OF ENGINEERS, WALTHAM, MA. NEW ENGLAND DIV.
Mussel Watch Program/Monitoring the Long-Term Effects of Dredged Material Disposal in New England Waters,
W87-03270 5B

CORPS OF ENGINEERS, WASHINGTON, DC.
Evolution of PMP Cooperative Studies,
W87-03063 8A

CORVALLIS ENVIRONMENTAL RESEARCH LAB., OR.
Environmental Gradients in Northwest Freshwater Wetlands,
W87-02615 2H

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Trend Analysis of Water Quality in the Sabarmati River at Ahmedabad for a Decade (1969-1978),
W87-03278 5G

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Biogeochemical Controls on River Water Quality in a Forested Drainage Basin, Warwickshire, UK,
W87-03292 2E

DELAWARE UNIV., LEWES. COLL. OF MARINE STUDIES.
Biomass and Structure of a Spartina alterniflora Loisel.-dominated Salt Marsh in France,
W87-03203 2L

DELAWARE UNIV., NEWARK. DEPT. OF CIVIL ENGINEERING.
Immiscible Contaminant Transport in Soils and Groundwater with an Emphasis on Petroleum Hydrocarbons: System of Differential Equations vs Single Cell Model,
W87-02729 5B

DELAWARE UNIV., NEWARK. DEPT. OF PLANT SCIENCE.
Boron Tolerance and Accumulation in the Duckweed, Lemna minor,
W87-03152 5C

Micronutrient Tolerance and Accumulation in the Duckweed, Lemna,
W87-03153 5C

DEPARTMENT OF AGRICULTURE, LETHBRIDGE (ALBERTA). RESEARCH STATION.
Effect of Irrigation and Nitrogen Fertilizer on the Yield and Protein Content of Soft White Spring Wheat,
W87-02877 3F

DEPARTMENT OF AGRICULTURE, MELFORT (SASKATCHEWAN). RESEARCH STATION.
Inexpensive System Using Drip-Emitters for Irrigating Small Plots,
W87-02876 3F

DEPARTMENT OF AGRICULTURE, SUMMERLAND (BRITISH COLUMBIA). RESEARCH STATION.
Effects of Frequency of Irrigation on Nutrient Uptake of Apple Trees,
W87-02875 3F

Effect of Woven Plastic Mulch, Herbicides, Grass Sod, and Nitrogen on 'Foch' Grapes Under Irrigation,
W87-03106 3F

DEPARTMENT OF AGRICULTURE, SWIFT CURRENT (SASKATCHEWAN). RESEARCH STATION.
Snow and Fertilizer Management for Continuous Zero-Till Spring Wheat,
W87-02879 3F

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W87-03325 2F

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Metal Concentrations in the Annual Shell Layers of the Bivalve Elliptio complanata,
W87-02764 5B

DEPARTMENT OF FISHERIES AND OCEANS, WINNIPEG (MANITOBA). FRESHWATER INST.
Interlaboratory Comparison of Analyses for Heavy Metals in Clam Tissue,
W87-03114 5A

DREXEL UNIV., PHILADELPHIA, PA. DEPT. OF BIOLOGICAL SCIENCES.
Chlorination to Prevent and Control Waterborne Diseases,
W87-02613 5F

Fungi in Potable Water Distribution Systems,
W87-02614 5B

DREXEL UNIV., PHILADELPHIA, PA. DEPT. OF CIVIL ENGINEERING.
Comparison of Clark's Presence-Absence Test and the Membrane Filter Method for Coliform Detection in Potable Water Samples,
W87-02892 5A

Designing for Flow,
W87-03125 8A

DREXEL UNIV., PHILADELPHIA, PA. ENVIRONMENTAL STUDIES INST.
Effects of Chloroform Toxicity on Methane Fermentation,
W87-02704 5D

DUKE UNIV., BEAUFORT, NC. MARINE LAB.
Effects of Light on Growth, RuBPCase Activity and Chemical Composition of Ulva Species (Chlorophyta),
W87-02809 2L

DUKE UNIV., DURHAM, NC. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Tc mination Criteria for Clay Permeability Testing,
W87-02788 2G

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Non-Darcian Transmission of Water in Certain Humified Peats,
W87-02846 2G

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W87-03024 5G

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W87-03287 2B

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Impacts of Water Quality Improvement on Site Visitation: A Probabilistic Modeling Approach,
W87-02622 4D

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W87-02730 5B

Dissolved Loads in Streams and Rivers - Discharged and Seasonally Related Variations,
W87-03279 5B

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W87-03037 8E

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W87-03039 5F

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W87-02781 5D

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W87-02690 8C

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Adaptation of an Existing Sill for Installation of a Siphon Plant, (Adaptation d'un Seuil Existant pour l'Implantation d'un Groupe en Siphon),
W87-02574 8C

Influence of the Runner Blade Angle Variation on Kaplan Turbine Transients, (Influence de la Variation d'Inclinaison des Pales sur les Regimes Transitoires des Turbines Kaplan),
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W87-03282 5G

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Effects of Hydraulic Projects and Their Management on Water Quality,
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ELECTRONIC TECHNIQUES, INC., FORT COLLINS, CO.
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Small Hydroelectric Power Plants for Very Low Heads, (Les Usines de Tres Basse Chute en Mini-Hydroelectricite),
W87-02571 8C

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Automation of a Chain of Run-of-River Power Stations,
W87-03035 8C

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Adapting Industrial Approaches to Municipal Wastewater Treatment Problems,
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Hydrometallurgy: Winning Metals with Water, W87-02618 5G

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Concentrations of 20 Volatile Organic Compounds in the Air and Drinking Water of 350 Residents of New Jersey Compared with Concentrations in Their Exhaled Breath, W87-02774 5B

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. ECONOMIC ANALYSIS DIV.
Travel Cost Model for Lake Recreation: A Comparison of Two Methods for Incorporating Site Quality and Substitution Effects, W87-02872 6D

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Drinking-Water Contribution to Natural Background Radiation, W87-03084 5F

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Effects of Water Quality Parameters on the Corrosion of Galvanized Steel, W87-02608 5G

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Dissolved Loads of Rivers: A Global Overview, W87-03273 5B

Stream Solute Behaviour in the River Exe Basin, Devon, UK, W87-03286 5B

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Floodplain Management Handbook. W87-03330 6F

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Determination of Acrylic Acid in Aqueous Samples by Electron Capture Gas Chromatography after Extraction with Tri-n-octylphosphine Oxide and Derivatization with Pentafluorobenzyl Bromide, W87-02818 5A

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Stemming the Loss of Coastal Wetland Habitats: Jamaica as a Model for Tropical Developing Countries, W87-03128 2L

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Antidegradation Policy for Preserving Surface Water Quality in Florida, W87-02636 5G

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Geochemistry of Tin in Rivers and Estuaries, W87-03140 5B

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Interactive Effects of Nitrogen and Water Stresses on Water Relations of Field-Grown Corn Leaves, W87-02994 2I

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FORT LAUDERDALE RESEARCH AND EDUCATION CENTER, FL.
Interactive Effects of Sewage Effluent Irrigation and Supplemental Fertilization on Container-Grown Trees, W87-02958 3C

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Dissolved and Suspended Loads of the Regulated River Nidda in the Rhine-Main Area, W87-03299 5B

FROSTBURG STATE COLL., MD. DEPT. OF GEOGRAPHY.
Basin Water Monitoring: Hydrologic Impact or Legal Compliance, W87-02940 6E

FUKUI UNIV. (JAPAN). FACULTY OF ENGINEERING.
Selective Preconcentration of Copper from Aqueous Solution by Using Kerateine Gel, W87-02802 5A

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Evaluation of Methods for Preservation of Water Samples for Nutrient Analysis, W87-03030 5A

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New Formula for the Analytical Solution of the Radial Dispersion Problem, W87-03199 2F

GREINER ENGINEERING, INC., DENVER, CO.

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Mathematical Modelling for Multi-Aquifer Groundwater Basins, W87-02848 2F

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Dissolved Organic Matter in Anoxic Pore Waters from Mangrove Lake, Bermuda, W87-03136 5A

Weathering Reactions, Water Chemistry and Denudation Rates in Drainage Basins of Different Bedrock Types: I - Sandstone and Shale, W87-03288 2K

Nutrient and Sediment Budgets for the Tidal Potomac River and Estuary, W87-03290 5B

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Generalization and Applications of Tracer Dispersion Data, W87-02620 5B

History of the Federal-State Cooperative Water Resources Research Institute Program, W87-02632 9D

GEOLOGICAL SURVEY, URBANA, IL. WATER RESOURCES DIV.
Effect of Rainfall Excess Calculations on Modeled Hydrograph Accuracy and Unit-Hydrograph Parameters, W87-02623 2B

GEORGIA UNIV., ATHENS. DEPT. OF BOTANY.
Rates of Mineral Element Leaching from Leaves of Nine Plant Species from a Southern Appalachian Forest Succession Subjected to Simulated Acid Rain, W87-03206 5C

GERAGHTY AND MILLER, INC., HACKENSACK, NJ.
Results of Pumping Tests in the Deccan Trap Basalts of Central India, W87-03076 2F

GIESSEN UNIV. (GERMANY, F.R.). INST. FUER MIKROBIOLOGIE UND LANDESKULTUR.
Comparison of Water Quality in Drainage Basins Under Agricultural and Forest Land Use, W87-03307 2E

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New Procedure for Extraction of Ammonium from Natural Waters for 15N Isotopic Ratio Determinations, W87-02902 5A

GREAT LAKES IRRIGATION LTD., HART, MI.
Trickle Irrigation System for Recycling Residential Wastewater on Fruit Trees, W87-02955 3C

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Innovative Lagoon Liner Pays Off, W87-03078 5D

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Comparison of Steady Infiltration Solutions for Spherical Cavities Under Simple Versus Variable Hydraulic Properties,
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R-Plasmid Transfer in Soil and Water,
W87-02792 5C

Triadimefon Protects Bean Plants from Water Stress through its Effects on Abscisic Acid,
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Corn Yield Response to Irrigation, Plant Population and Nitrogen in a Cool, Humid Climate,
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Effects of Carbon Dioxide Enrichment and Soil Water on Maize,
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Interactive Effects of Trickle Irrigation Rates, Cultivars, and Culture on Cut Chrysanthemum,
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HADASSAH MEDICAL SCHOOL, JERUSALEM (ISRAEL). ENVIRONMENTAL HEALTH LAB.
Analysis of Tap Water for Viruses: Results of a Survey,
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Humic Acid Interference with Virus Recovery by Electropositive Microporous Filters,
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Spectrophotometric Determination of Chromium in Waste Water and Soil,
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HARVARD UNIV., CAMBRIDGE, MA. CENTER FOR EARTH AND PLANETARY PHYSICS.
Chemical Control of Soluble Phosphorus in the Amazon Estuary,
W87-03139 5B

HEALTH AND WELFARE CANADA, OTTAWA (ONTARIO). MONITORING AND CRITERIA DIV.
Halogenated Phenols in Water at Forty Canadian Potable Water Treatment Facilities,
W87-03112 5F

HEALTH EFFECTS RESEARCH LAB., CINCINNATI, OH.
Waterborne Viral Gastroenteritis,
W87-02612 5C

Improved Method for Recovery of Enteric Viruses from Wastewater Sludges,
W87-02710 5A

HEATH CONSULTANTS, INC., HOUSTON, TX.
Instruments and Expertise Add Up to Good Pipe Locating,
W87-02928 8C

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Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: I. Salinity During Growth Modulates the Proton Pump in the Halophyte Atriplex Nummularia,
W87-02717 2I

Studies on H(+)-Translocating ATPases in Plants of Varying Resistance to Salinity: II. K(+) Strongly Promotes Development of Membrane Potential in Vesicles from Cotton Roots,
W87-02718 2I

HELIX SOFTWARE CONSULTANTS, LONDON (ENGLAND).
Hydrology of a Sloping, Structured Clay Soil at Wytham, Near Oxford, England,
W87-02685 2G

HELSINKI UNIV. (FINLAND). DEPT. OF GEOLOGY.
Environmental Factors Affecting the Acid Neutralization Capacity of Finnish Glacial Till Deposits,
W87-02588 5B

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Test of a Proposed Organizational Framework for the Ordering of Algal Toxicity Responses,
W87-03205 5C

HIROSHIMA UNIV. (JAPAN). FACULTY OF INTEGRATED ARTS AND SCIENCES.
Determination of Organically-associated Trace Metals in Estuarine Sea-Water by Solvent Extraction and Atomic-Absorption Spectrometry,
W87-03173 5A

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Virus Inactivating Effect of Anaerobic Mesophilic Digestion of Municipal Sludge With or Without Different Preceding Types of Treatment,
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Computation of Hydraulic Transients in Complex Hydro Schemes,
W87-03036 8A

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Anomalous Binding of Organic Contaminants May Be Artifactual Due to Radiochemical Impurities,
W87-02700 5A

Membrane Filtration Enumeration of Faecal Clostridia and Clostridium Perfringens in Water,
W87-02701 5A

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Changes in Spring Wheat Tillering Patterns in Response to Delayed Irrigation,
W87-03012 2I

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Root Distribution and Water Uptake Patterns of Maize Cultivars Field-Grown under Differential Irrigation,
W87-02817 2I

ILLINOIS STATE ENVIRONMENTAL PROTECTION AGENCY, SPRINGFIELD.
Plan for Protecting Illinois Groundwater.
W87-03331 6B

ILLINOIS STATE WATER SURVEY DIV., CHAMPAIGN.
Use of Climate Predictions to Decide a Water Management Problem,
W87-02633 6A

ILLINOIS STATE WATER SURVEY, PEORIA. WATER QUALITY SECTION.
Toxicity Tests of Aquatic Pollutants by Using Common Duckweed,
W87-02582 5A

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Techniques for Measuring Plant Water,
W87-02950 7B

Seasonal Growth and Composition and Accumulation of N-P-K in Dryland and Irrigated Pumpkins,
W87-03150 2I

ILORIN UNIV. (NIGERIA). DEPT. OF GEOGRAPHY.
Financial Viability and Economic Efficiency of Water Supply in Kwara State - The Case of Ilorin,
W87-03046 5F

IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND). DEPT. OF CIVIL ENGINEERING.
Slack Tide Oxygen Balance Model,
W87-02889 5B

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Extreme Value Theory Based on the r Largest Annual Events,
W87-03069 2L

IMPERIAL COLL. OF SCIENCE AND TECHNOLOGY, LONDON (ENGLAND). PUBLIC HEALTH ENGINEERING LAB.
Nitrilotriacetic Acid in Sludge-amended Soil: Mobility and Effects on Metal Solubility,
W87-02765 5E

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Compaction and Tillage Depth Combinations for Water Management and Rice Production in Low-Retentive Permeable Soils,
W87-03163 3F

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Emergence of Environmental Law in the Developing Countries: A Case Study of India,
W87-02616 6E

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Water and the Third Millennium,
W87-03044 5F

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Water Supply in the Northeast: A Study in Regulatory Failure,
W87-02590 6E

INLAND WATERS DIRECTORATE, OTTAWA (ONTARIO). WATER PLANNING AND MANAGEMENT BRANCH.
Structural Change Implications for Industrial Water Use,
W87-03190 6D

INSTITUT ARMAND-FRAPPIER, LAVAL (QUEBEC). CENTRE DE RECHERCHE EN VIROLOGIE.
Detection and Health Risk Associated with Low Virus Concentration in Drinking Water,
W87-02653 5A

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W87-02796 5A

Multielement Trace Preconcentration from Water on Activated Carbon for the Sample Pretreatment for Atomic Spectroscopy (Flame-AAS, ICP/OES), (Multielement-Spurenanreicherung aus Wassern an Aktivkohle zur Probenvorbereitung fur die Atomspektroskopie (Flammen-AAS, ICP/OES)),
W87-02799 5A

INSTITUT PASTEUR HELLENIQUE, ATHENS (GREECE). DEPT. OF VIROLOGY.
Detection of Indigenous Enteric Viruses in Raw Sewage Effluents of the City of Athens, Greece, during a Two Year Survey,
W87-02659 5B

INSTITUTE OF HYDROLOGY, WALLINGFORD (ENGLAND).
Modelling the Effects of Hydrological Changes on Stream Water Acidity,
W87-02684 2E

Modelling the Effects of Acidic Deposition And Conifer Afforestation on Stream Acidity in the British Uplands,
W87-03068 5C

Unbiased Plotting Positions for the General Extreme Value Distribution,
W87-03071 2E

Changes in Catchment Runoff Following Drainage and Afforestation,
W87-03072 4C

Value of Historical Data in Flood Frequency Analysis,
W87-03200 2E

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Effect of O2 Concentration on Dark H2 Oxidation in Whole Cells of a Marine Sulfur Photosynthetic Bacterium (Chromatium sp. Strain Miami PBS 1071),
W87-03211 2L

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Interpretation of Tracer Data in Variable Flow Systems,
W87-03070 7B

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Cost Analysis of the Adverse Effects of Algal Growth in Water Bodies on Drinking Water Supply,
W87-02977 5F

INSTITUTO DE AGROQUIMICA Y TECNOLOGIA DE ALIMENTOS, VALENCIA (SPAIN).
Flame Absorption Spectroscopic Determination of Cadmium, Copper, Iron, Lead, and Zinc in Mussels,
W87-03115 5A

INTERNATIONAL ASSOCIATION OF HYDROLOGICAL SCIENCES.
Dissolved Loads of Rivers and Surface Water Quantity/Quality Relationships.
W87-03272 5B

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Water Deficit During Panicle Development in Pearl Millet: Yield Compensation by Tillers,
W87-03157 2I

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Mechanized Tillage Systems Effects on Properties of a Tropical Alfisol in Watersheds Cropped to Maize,
W87-03162 2G

Effects of Tillage Methods and Water Regimes on Soil Properties and Yield of Lowland Rice from a Sandy Loam Soil in Southwest Nigeria,
W87-03164 2I

INTERNATIONAL INST. OF TROPICAL AGRICULTURE, IBADAN (NIGERIA). FARMING SYSTEMS PROGRAM.
Soil Water Balance of Intercropped Maize and Cowpea Grown in a Tropical Hydromorphic Soil in Western Nigeria,
W87-02989 2I

IOWA COOPERATIVE WILDLIFE RESEARCH UNIT, AMES.
Environmental Effects of Dikes and Revetments on Large Riverine Systems,
W87-03321 6G

IOWA STATE UNIV., AMES.
Managing Water for Turfgrass,
W87-03016 2I

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Alternatives to the Use of Agricultural Drainage Wells,
W87-02624 4B

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Climatic Change, Weather Variability, and Corn Production,
W87-03006 2I

IOWA STATE UNIV., AMES. DEPT. OF HORTICULTURE.
Differential Sensitivity of Turfgrass Organs to Water Stress,
W87-02962 2I

Soil Compaction and Moisture Stress Preconditioning in Kentucky Bluegrass. I. Soil Aeration, Water Use, and Root Responses,
W87-02982 2G

Soil Compaction and Moisture Stress Preconditioning in Kentucky Bluegrass. II. Stomatal Resistance, Leaf Water Potential, and Canopy Temperature,
W87-02983 2G

IOWA UNIV., IOWA CITY. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Fundamentals of Anaerobic Digestion of Wastewater Sludges,
W87-02884 5D

ITH, CASTELNAU-LE-LEZ (FRANCE).
Small Power Stations Abroad, (Aspects Specifiques de Minicentrales a l'Etranger),
W87-02566 8C

ITHACA COLL., NY. DEPT. OF BOTANY.
Distribution and Standing Crop of Living and Dead Roots in Three Wetland Carex Species,
W87-03204 2H

IWATE UNIV., MORIOKA (JAPAN). DEPT. OF CIVIL ENGINEERING.
Behaviour of Coliphages in Oxidation Ponds,
W87-02666 5D

JAMES N. GAMBLE INST. OF MEDICAL RESEARCH, CINCINNATI, OH.
Mechanism of Inactivation of Enteric Viruses in Fresh Water,
W87-02893 5B

JAPAN SEDIMENTS MANAGEMENT ASSOCIATION.
Results of Sedimentation and Elutriate Tests from Osaka Bay Sediment,
W87-03258 2J

JAPAN SEDIMENTS MANAGEMENT ASSOCIATION, KYOTO.
In Situ Stream Water Clarifying Tests,
W87-03265 5G

JAWAHARLAL NEHRU UNIV., NEW DELHI (INDIA). SCHOOL OF ENVIRONMENTAL SCIENCES.
Association Between Some Planktonic Species and Physicochemical Characteristics of the Water of Loktak Lake, Manipur, India,
W87-03025 2H

Factors Controlling the Chemical Composition of River Waters of India,
W87-03285 2E

JOHANNESBURG CITY HEALTH DEPT. LABS. (SOUTH AFRICA).
Readily Biodegradable Fraction of Sewage: Its Influence on Phosphorus Removal and Measurement,
W87-02738 5D

Role of Bacterial Phosphate Metabolism in Enhanced Phosphorus Removal from the Activated Sludge Process,
W87-02743 5D

JOHN INNES INST., NORWICH (ENGLAND).
Alcohol Dehydrogenase Activity in the Roots of Marsh Plants in Naturally Waterlogged Soils,
W87-02816 2I

JOHNS HOPKINS UNIV., BALTIMORE, MD. DEPT. OF SANITARY ENGINEERING AND WATER RESOURCES.
Planning and Technology in Sanitary and Environmental Engineering,
W87-03098 6A

KAGOSHIMA UNIV. (JAPAN). DEPT. OF APPLIED CHEMISTRY.
Bioaccumulation of Arsenic by Freshwater Algae and the Application to the Removal of Inorganic Arsenic from an Aqueous Phase: Part II. by Chlorella vulgaris Isolated from Arsenic-Polluted Environment,
W87-02907 5B

KANSAS AGRICULTURAL EXPERIMENT STATION, MANHATTAN. EVAPOTRANSPIRATION LAB.
Techniques for Water-Use Measurements of Crop Plants,
W87-02949 7B

Remote Sensing Techniques for Assessing Water Deficits and Modeling Crop Response,
W87-02953 7B

Problems of Using Wastewater on Vegetable Crops,
W87-02954 3C

KANSAS STATE UNIV., MANHATTAN. DIV. OF BIOLOGY.
Leaf Litter Processing and the Associated Invertebrate Fauna in a Tallgrass Prairie Stream,
W87-03097 2H

KARLSRUHE UNIV. (GERMANY, F.R.). INST. FUER HYDROMECHANIK.
Experiments on Vertical Plane Buoyant Jets in Shallow Water,
W87-02762 8B

KENTUCKY AGRICULTURAL EXPERIMENT STATION, LEXINGTON. DEPT. OF AGRONOMY.
Water Sorption Characteristics of Aluminum- and Calcium-Saturated Soil Clays,
W87-02728 2G

KENTUCKY UNIV., LEXINGTON. DEPT. OF CIVIL ENGINEERING.
Modified Diffusion Equation for Flood Propagation in Trapezoidal Channels,
W87-02855 2E

KERNFORSCHUNGSANLAGE JUELICH G.M.B.H. (GERMANY, F.R.). INST. FUER ANGEWANDTE PHYSIKALISCHE CHEMIE.
Trace Determination of Chromium in Various Water Types by Adsorption Differential Pulse Voltammetry,
W87-02797 5A

KIEL UNIV. (GERMANY, F.R.). INST. FUER POLAROKOLOGIE.
Structuring of Ecological Data Sets by Methods of Correlation and Cluster Analysis,
W87-02597 2L

KILLAM (ELSTON T.) ASSOCIATES, INC., MILLBURN, NJ.
Overcoming Natural and Man-Made Obstacles to Solve Urban Flooding Problems,
W87-03118 4C

KITAKYUSHU MUNICIPAL INST. OF ENVIRONMENTAL HEALTH SCIENCES (JAPAN).
Virus Removal by Activated Sludge Treatment,
W87-02658 5D

KNEPPER, WHITE, ARTER AND HADDEN, COLUMBUS, OH.
Moving Toward a Coordinated Groundwater Management Approach - A Legislative Proposal,
W87-03315 6E

KONGELIGE VETERINAER- OG LANDBOHOEJSKOLE, COPENHAGEN (DENMARK). DEPT. OF VETERINARY VIROLOGY AND IMMUNOLOGY.
Detection and Stability of Enteric Viruses in Sludge, Soil and Ground Water,
W87-02662 5B

Examination of the Penetration of Enteric Viruses in Soils under Simulated Conditions in the Laboratory,
W87-02663 5B

KURITA WATER INDUSTRIES LTD., YOKOHAMA (JAPAN). KURITA CENTAL LABS.
Factors Affecting Biological Removal of Phosphorus,
W87-02748 5D

KYOTO CIVIL ENGINEERING AND CONSTRUCTION DEPT. (JAPAN).
Progressive Trenching Using a Scraper Digger,
W87-03268 5E

Environmental Conservation in the Port of Maizuru,
W87-03269 5B

KYOTO UNIV. (JAPAN).
Some Experimental Discussion of Accuracies in Quantitative Virus Assessment for Water Supply,
W87-02656 5A

KYOTO UNIV. (JAPAN). DEPT. OF CIVIL ENGINEERING.
Lime-Cement Hardening of Very Soft Freshwater Clay,
W87-03260 8D

KYOTO UNIV. (JAPAN). DEPT. OF ENVIRONMENTAL AND SANITARY ENGINEERING.
Rational Allocation of Monitoring Stations in a Lake by Means of the Spline Technique,
W87-02598 7A

KYOTO UNIV. (JAPAN). FACULTY OF ENGINEERING.
Eutrophication Model of Lake Kasumigaura,
W87-02971 2H

KYOTO UNIV., OSAKA (JAPAN). RESEARCH REACTOR INST.
Continuous Monitoring of 222Rn Concentration in Unconfined Groundwater,
W87-02847 5A

LANCASTER UNIV., BAILRIGG (ENGLAND). DEPT. OF BIOLOGICAL SCIENCES.
Water or Salt Stress Increases Infectivity of Erysiphe pisi Conidia Taken from Stressed Plants,
W87-03175 5C

LE HARVE UNIV. (FRANCE). LAB. DE MECANIQUE DES FLUIDES.
Analysis of the Velocity Field in a Boundary Layer Generated by a Water Wave, (Analyse du Champ des Vitesses dans la Couche Limite Generee par une Onde Progressive (Houle)),
W87-02790 8B

LEBENSMITTELVERSUCHSANSTALT, VIENNA (AUSTRIA). FORSCHUNGSINSTITUT DER ERNAEHRUNGSWIRTSCHAFT.
Determination of Halogenated Solvent Residues in Water, Waste Water, Feeding-Stuffs, and Food, (Bestimmung halogenierter Losungsmittelruckstande in Wasser, Abwasser, Futter- und Lebensmitteln),
W87-03086 5A

LEROY-SOMER, ANGOULEME (FRANCE).
Creation of a Cross-Flow Turbines Range, (Creation d'une Gamme de Turbines a Flux Traversant),
W87-02569 8C

LESCO, INC., ROCKY RIVER, OH.
Soils Influence Irrigation,
W87-03020 2G

LILLY (ELI) AND CO., INDIANAPOLIS, IN. LILLY RESEARCH LAB.
Liquid Chromatographic Determination of Fluridone Aquatic Herbicide and Its Metabolite in Fish and Crayfish,
W87-03113 5A

LOUDOUN COUNTY SANITATION AUTHORITY, LEESBURG, VA.
Waterford Treatment Plant - A Small Town Lagoon System,
W87-02834 5D

LOUGHBOROUGH UNIV. OF TECHNOLOGY (ENGLAND). DEPT. OF GEOGRAPHY.
Wave Movement and Water-Quality Variations During a Controlled Release from Kielder Reservoir, North Tyne River, U. K.,
W87-02681 2E

LOUISIANA AGRICULTURAL EXPERIMENT STATION, BATON ROUGE.
Influence of Climatic Factors and Forage Age on the Chemical Components of Ryegrass Related to Grass Tetany,
W87-02980 2I

LOUISIANA STATE UNIV., BATON ROUGE. DEPT. OF AGRONOMY.
Goodness of Fit for Eight Water Infiltration Models,
W87-02923 2G

LOUISIANA STATE UNIV., BATON ROUGE. LAB. FOR WELAND SOILS AND SEDIMENTS.
Radionuclide Concentrations in Louisiana Soils and Sediments,
W87-03085 5B

LYONNAISE DES EAUX, LE PECQ (FRANCE). LAB. CENTRAL.
Importance of the Acidogenic Microflora in Biological Phosphorus Removal,
W87-02749 5D

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Effect of Rootstock on Apple (Malus domestica) Tree Water Relations,
W87-03056 2I

MARBURG UNIV. (GERMANY, F.R.). FACHBEREICH CHEMIE.
Studies on Sediments of the River Lahn: 1. Analytical Results, (Untersuchungen an Lahnsedimenten: 1. Analytische Ergebnisse),
W87-02800 5B

Studies on Sediments of the River Lahn: 2. Chemometric Evaluation, (Untersuchungen an Lahnsedimenten: 2. Chemometrische Auswertung),
W87-02801 5B

MARINE INDUSTRIES LTD., SOREL (QUEBEC). GENERATOR SECTION.
Geological Problems Overcome at Revelstoke: Part Two,
W87-02692 8D

MARMARA SCIENTIFIC AND INDUSTRIAL RESEARCH INST., GEBZE (TURKEY). DEPT. OF NUTRITION AND FOOD TECHNOLOGY.
Determination of Pollution and Eutrophic Conditions of Sapanca Lake (Turkey),
W87-02587 5B

MARTIN-LUTHER-UNIV. HALLE-WITTENBERG, HALLE (GERMAN D.R.). SEKTION GEOGRAPHIE.
Physiogenic and Anthropogenic Controls of Global and Regional Ionic Runoff,
W87-03275 2E

MARYLAND UNIV., COLLEGE PARK.
Salinity Tolerance of Winged Bean as Compared With That of Soybean,
W87-02988 3C

MARYLAND UNIV., COLLEGE PARK. DEPT. OF AGRONOMY.
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W87-03161 5B

MARYLAND UNIV., COLLEGE PARK. DEPT. OF CHEMISTRY.
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W87-03050 5A

MARYLAND UNIV., COLLEGE PARK. DEPT. OF MICROBIOLOGY.
Viable but Nonculturable Stage of Campylobacter jejuni and Its Role in Survival in the Natural Aquatic Environment,
W87-02899 5B

MASSACHUSETTS INST. OF TECH., CAMBRIDGE. CENTER FOR METEOROLOGY AND PHYSICAL OCEANOGRAPHY.
Possible Role of Symmetric Instability in the Formation of Precipitation Bands,
W87-03213 2B

MASSACHUSETTS UNIV., AMHERST. DEPT. OF CIVIL ENGINEERING.
Hydraulics of Rectangular Clarifiers,
W87-02886 8B

MASSACHUSETTS UNIV. AT BOSTON. ENVIRONMENTAL SCIENCE PROGRAM.
Effect of Organotins on Fecal Pollution Indicator Organisms,
W87-02901 5C

MCGILL UNIV., MONTREAL (QUEBEC). DEPT. OF BIOLOGY.
Effect of Catchment Size on Phosphorus Export,
W87-02941 5B

MCGILL UNIV., MONTREAL (QUEBEC). FACULTY OF ENGINEERING.
Absence of Acclimation to Parathion by Rainbow Trout During Sublethal Exposure,
W87-02697 5C

MEDIZINISCHE AKADEMIE 'CARL GUSTAV CARUS' DRESDEN (GERMAN D.R.). INST. FUER ALLGEMEINE UND KOMMUNALE HYGIENE.
Interactions between Biotic and Abiotic Factors and Viruses in a Water System,
W87-02657 5B

MEI-CHARLTON, INC., PORTLAND, OR.
Waterline Problems can be Avoided with Care and Testing,
W87-02904 8A

MEMORIAL UNIV. OF NEWFOUNDLAND, ST. JOHN'S. DEPT. OF PHYSICS.
Vertical Diffusion in Meromictic Powell Lake, British Columbia,
W87-02780 2H

MEMORIAL UNIV. OF NEWFOUNDLAND, ST. JOHN'S. FACULTY OF ENGINEERING AND APPLIED SCIENCE.
Effect of Waves on Buoyant Jets,
W87-02964 5B

METRO EAST SANITARY DISTRICT, GRANITE CITY, IL.
Professional Tank Cleaning Can Make a Difference,
W87-03080 5D

METROPOLITAN COUNCIL, ST. PAUL, MN.
Pollutants Associated with Sand and Salt Applied to Roads in Minnesota,
W87-02943 5B

MIAMI UNIV., CORAL GABLES, FL. COLL. OF ENGINEERING.
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W87-03089 5B

MICHIGAN STATE UNIV., EAST LANSING. INST. OF WATER RESEARCH.
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W87-02605 5F

MID-KENT COLL. OF HIGHER AND FURTHER EDUCATION, CHATHAM (ENGLAND).
Review of the Role of Bed Deposits in the Phosphate Eutrophication of Lakes and Rivers,
W87-03022 5B

MILAN UNIV. (ITALY). DEPT. OF PHYSICAL CHEMISTRY AND ELECTROCHEMISTRY.
Predicting Standard pH Values for Reference Buffer Solutions in Solvent Mixtures with Water,
W87-03049 5A

MILJOESTYRELSEN, COPENHAGEN (DENMARK).
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W87-03302 5B

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W87-02677 2F

Location of an Interface Observation Well: A Bayesian Approach,
W87-03187 2F

MINISTRY OF CONSTRUCTION, TOKYO (JAPAN). KANTO REGIONAL CONSTRUCTION BUREAU.
Purification of Nho River by the Gravel Contact Method,
W87-03266 5G

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Wastewater Treatment by Soil,
W87-03264 5D

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W87-03274 5B

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Application of Environmental Management Principles in the Program for Eradication of Aedes (Stegomyia) aegypti (Linneus, 1762) in the Republic of Cuba, 1984,
W87-02824 5G

MINISTRY OF TRANSPORT, KOBE (JAPAN). 3RD DISTRICT PORT CONSTRUCTION BUREAU.
Influence of Accumulating Organic Sediment on the Marine Environment in Osaka Bay,
W87-03257 5C

MINISTRY OF WORKS AND DEVELOPMENT, CHRISTCHURCH (NEW ZEALAND). HYDROLOGY CENTRE.
Transport of Gravel by Flows up to 500 cu m/s, Ohau River, Otago, New Zealand,
W87-02773 2J

MINISTRY OF WORKS AND DEVELOPMENT, HAMILTON (NEW ZEALAND). WATER QUALITY CENTRE.
Developing Management Guidelines for River Nitrogenous Oxygen Demand,
W87-02822 5G

MINNESOTA UNIV., MINNEAPOLIS. ST. ANTHONY FALLS HYDRAULIC LAB.
Passive Screen Water Intake Design Studies,
W87-02767 8I

Designing Intakes to Avoid Free-Surface Vortices,
W87-03034 8B

MONASH UNIV., CLAYTON (AUSTRALIA). DEPT. OF CIVIL ENGINEERING.
Determination of Rainfall Excess on Spatially Variable Catchments,
W87-02853 2A

MONROVIA NURSERY CO., AZUSA, CA.
Recycling Irrigation Runoff on Container Ornamentals,
W87-02956 3F

MONTANA STATE UNIV., BOZEMAN. DEPT. OF MICROBIOLOGY.
Bacteria Associated with Granular Activated Carbon Particles in Drinking Water,
W87-02891 5B

MONTANA STATE UNIV., BOZEMAN. DEPT. OF PLANT AND SOIL SCIENCE.
Effect of Standing Small Grain Stubble on Snow Cover Characteristics in Alternate Fallow Strip Cropping,
W87-02990 2C

MONTPELLIER-2 UNIV. (FRANCE). LAB. D'HYDROGEOLOGIE.
Evolution in Space and Time of an Alluvial Aquifer under the Effect of an Exceptional Multi-Year Drought (Mediterranean Shore, Herault, France) (Evolution Spatio-Temporelle d'un Aquifere Alluvial sous l'Effet d'une Secheresse Pluriannuelle Exceptionnelle (Littoral Mediterraneen, Herault, France)),
W87-02838 2F

MOUNT SINAI SCHOOL OF MEDICINE, NEW YORK. ENVIRONMENTAL SCIENCES LAB.
Asbestos in Potable Water Supplies and Attributable Risk of Gastrointestinal Cancer,
W87-02830 5C

MUNICH UNIV. (GERMANY, F.R.). GEOGRAPHISCHE INST.
Heavy Metal Content in Sediments of Lakes in Southern Bavaria as a Sign of Long-Term Environmental Impact,
W87-03305 5C

NANCY-1 UNIV. (FRANCE). LAB. D'HYGIENE ET DE RECHERCHE DE LA SANTE PUBLIQUE.
Study of Indigenous Virus Removal at Different Stages in a Drinking Water Plant Treating River Water,
W87-02665 5F

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Atmospheric Methane Sources: Alaskan Tundra Bogs, an Alpine Fen, and a Subarctic Boreal Marsh,
W87-02719 5B

NATIONAL CHENG KUNG UNIV., TAINAN (TAIWAN). DEPT. OF ENVIRONMENTAL ENGINEERING.
Starch Waste Treatment by the Activated Sludge System,
W87-02705 5D

NATIONAL ENVIRONMENTAL ENGINEERING RESEARCH INST., NAGPUR (INDIA).
Growth of Salmonellas in Different Enrichment Media,
W87-02786 5A

NATIONAL ENVIRONMENTAL ENGINEERING RESEARCH INST., NAGPUR (INDIA). WATER ENGINEERING DIV.
Innovative Technique for Determining Velocity Gradient in Coagulation--Flocculation Process,
W87-02708 5F

NATIONAL HYDROLOGY RESEARCH INST., OTTAWA (ONTARIO).
Retardation of Toxic Chemicals in a Contaminated Outwash Aquifer,
W87-02731 5B

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Chromatic Regulation of Photosystem Composition in the Photosynthetic System of Red and Blue-Green Algae,
W87-03212 2H

NATIONAL INST. FOR ENVIRONMENTAL STUDIES, TSUKUBA (JAPAN). LAB. OF FRESHWATER ENVIRONMENT.
Model of Nitrogen Release from Bottom Sediments,
W87-03250 5B

NATIONAL INST. FOR ENVIRONMENTAL STUDIES, TSUKUBA (JAPAN). LAB. OF MARINE ENVIRONMENT.
Interaction Between Motile Phytoplankton and Langmuir Circulation,
W87-02969 2L

NATIONAL INST. FOR ENVIRONMENTAL STUDIES, TSUKUBA (JAPAN). SYSTEMS ANALYSIS AND PLANNING DIV.
Model Simulation of Solute Leaching and Its Application for Estimating the Net Rate of Nitrate Formation under Field Conditions,
W87-02839 5B

NATIONAL INST. FOR ENVIRONMENTAL STUDIES, TSUKUBA (JAPAN). WATER AND SOIL ENVIRONMENT DIV.
Synthesis and Analysis of a Comprehensive Lake Model - With the Evaluation of Diversity of Ecosystems,
W87-02965 2H

Box Model for Prediction of Water Quality in Eutrophic Lakes,
W87-02972 2H

NATIONAL INST. FOR WATER RESEARCH, PRETORIA (SOUTH AFRICA).
Recovery of Viruses from Drinking-Water by Means of an In-Line Electropositive Cartridge Filter,
W87-02649 5A

Interaction of Different Groups of Micro-Organisms in Biological Phosphate Removal,
W87-02739 5D

Practical Direct Plaque Assay for Coliphages in 100-ml Samples of Drinking Water,
W87-02890 5A

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Relationships Among Growth Rate, Cellular Manganese Concentrations and Manganese Transport Kinetics in Estuarine and Oceanic Species of the Diatom Thalassiosira,
W87-02805 2L

NATIONAL MARINE FISHERIES SERVICE, HIGHLANDS, NJ. SANDY HOOK LAB.
Organic and Trace Metal Levels in Ocean Quahog, Arctica islandica Linne, from the Northwestern Atlantic,
W87-02759 5B

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W87-02771 5C

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Partitioning of 7 Beryllium in Fresh Water,
W87-03142 5A

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W87-03127 5C

NATIONAL VETERINARY INST., OSLO (NORWAY).
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W87-02585 5B

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Comparison of MOBED and HEC-6 River Flow Models,
W87-02669 2E

NATIONAL WATER RESEARCH INST., BURLINGTON (ONTARIO). HYRDRAULICS RESEARCH DIV.
Mixing Coefficient for Ice-covered and Free-surface Flows,
W87-02671 2E

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W87-03308 6E

Groundwater: Its Occurrence, Movement and Potential for Pollution,
W87-03309 2F

State Common Law Water Rights in the Context of the Federal System,
W87-03312 6E

NAVAL OCEAN SYSTEMS CENTER, SAN DIEGO, CA. ENVIRONMENTAL SCIENCES DIV.
Ecological Evaluation of Organotin-Contaminated Sediment,
W87-03254 5B

NEBRASKA UNIV.-LINCOLN. CENTER FOR AGRICULTURAL METEOROLOGY AND CLIMATOLOGY.
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W87-02937 6E

NEBRASKA UNIV.-LINCOLN. DEPT. OF AGRONOMY.
Use of Portable Rainout Shelters to Induce Water Stress,
W87-02991 2I

Water Use Efficiency in Soybean Pubescence Density Isolines-A Calculation Procedure for Estimating Daily Values,
W87-03000 2I

NEVADA UNIV., RENO. DEPT. OF AGRICULTURAL AND RESOURCE ECONOMICS.
Stochastic Dominance Comparison of Water-Conserving Irrigation Strategies,
W87-02873 3F

NEW HAMPSHIRE UNIV., DURHAM.
Development of a Collision Tolerant Pile Structure Concept,
W87-03219 8A

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W87-02635 5G

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W87-02939 5C

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W87-02993 3F

NEW MEXICO UNIV., ALBUQUERQUE. NATURAL RESOURCES CENTER.
Ixtapa Draft Agreement Relating to the Use of Transboundary Groundwaters,
W87-02592 6E

NEW ORLEANS BOARD OF COMMISSIONERS OF THE PORT, LA.
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W87-03267 5E

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W87-02826 5C

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W87-02828 5G

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W87-02832 5B

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W87-03065 5G

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W87-03169 3F

NEYRPIC, GRENOBLE (FRANCE).
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W87-02578 8C

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W87-02570 8C

NISHIKI CONSULTANT CO. LTD., TOKYO (JAPAN).
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W87-03259 5E

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF BIOLOGICAL AND AGRICULTURAL ENGINEERING.
Drains as a Boundary Condition in Finite Elements,
W87-03201 2F

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF CROP SCIENCE.
Fluridone Retention and Release in Soils,
W87-02918 5B

NORTH CAROLINA STATE UNIV. AT RALEIGH. DEPT. OF MARINE, EARTH AND ATMOSPHERIC SCIENCES.
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W87-02807 2L

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Corn Irrigation Scheduling in Humid Regions on Sandy Soils with Tillage Pans,
W87-02981 3F

Response of Corn to Tillage and Delayed Irrigation,
W87-03007 2I

NORTH CAROLINA UNIV. AT CHAPEL HILL. DEPT. OF BIOLOGY.
Effects of Variation in Streamside Habitats on the Composition of Mountain Salamander Communities,
W87-03082 2H

NORTH CAROLINA UNIV. AT CHAPEL HILL. DEPT. OF CITY AND REGIONAL PLANNING.
Financial Planning Model and Its Application,
W87-03058 6B

NORTH CAROLINA UNIV. AT CHAPEL HILL. DEPT. OF ENVIRONMENTAL SCIENCES AND ENGINEERING.
Detection of Hepatitis A Virus (HAV) in Drinking Water,
W87-02646 5A

Water and Hygiene: The Case of North Carolina Farmworkers,
W87-02756 6D

NORTH DAKOTA STATE UNIV., FARGO.
Soil-Water Determination Using Fiber Optics,
W87-02723 2G

NORTHEAST UTILITIES SERVICE CO., HARTFORD, CT.
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W87-02599 7C

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Prediction of the Distribution Constant of some Solutes Containing Hydrophilic Functional Groups from Data on the Solubility of Water in Organic Solvents,
W87-02906 1B

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Seasonal, Behavioral and Growth Changes of Juvenile Corbicula Fluminea Exposed to Chrysotile Asbestos,
W87-02699 5C

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W87-03135 5E

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W87-03277 5B

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W87-03313 6E

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W87-03314 6E

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W87-03311 6E

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W87-03066 6G

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W87-03172 5A

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Influence of Soil Structure on Movement Rate of Salts Through Soils,
W87-02716 5B

OKLAHOMA STATE UNIV., STILLWATER. SCHOOL OF CIVIL ENGINEERING.
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W87-02751 5D

OKLAHOMA UNIV., NORMAN. SCHOOL OF METEOROLOGY.
Structure, Energetics and Propagation of Rotating Convective Storms. Part I: Energy Exchange with the Mean Flow,
W87-03215 2B

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W87-03088 5D

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W87-03165 3F

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Assessment of the Impact of Eutrophication Control Measures on South African Impoundments,
W87-02973 5G

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W87-02992 2I

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W87-02808 2H

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W87-02631 5B

Morphological Features of Small Streams: Significance and Function,
W87-02931 4A

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W87-02836 5B

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W87-03074 2G

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W87-02975 5B

Analysis and Cartographical Approach to the Regional Water Utilization System in the Yodo River Basin,
W87-02978 6D

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W87-02706 5D

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W87-02644 5G

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Watershed Modeling for Fire Management Planning in the Northern Rocky Mountains,
W87-03323 4D

Measuring Suspended Sediment in Small Mountain Streams,
W87-03324 5A

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W87-03336 2C

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W87-03337 7B

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W87-02564 5B

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W87-03296 5B

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W87-03281 5B

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W87-03083 5C

POLYTECHNIC WOLVERHAMPTON (ENGLAND).
Compaction, Hydrological Processes and Soil Erosion on Loamy Sands in East Shropshire, England,
W87-03160 2J

Influence of Catastrophic Floods on Water Quality as Recorded in the Sediments of Blagdon Lake, England,
W87-03306 2H

PORT AND HARBOUR RESEARCH INST., TOKYO (JAPAN).
Numerical Prediction on the Effect of Phosphorus Release Control by Sediment Dredging,
W87-03253 5B

PORTLAND CEMENT ASSOCIATION, DENVER, CO.
RCC: A Dam Rehab Solution Unearthed,
W87-02770 8F

PORTLAND STATE UNIV., OR. DEPT. OF CIVIL ENGINEERING.
Decision Support System for Local Water Management,
W87-03064 6D

PRETORIA UNIV. (SOUTH AFRICA). DEPT. OF CHEMISTRY.
Automated Prevalve Dilution in Flow-Injection Analysis: The Automated Determination of Chloride in Surface, Ground and Domestic Water,
W87-02793 5A

PRETORIA UNIV. (SOUTH AFRICA). DEPT. OF MICROBIOLOGY AND PLANT PATHOLOGY.
Aut-Ecological Study of Acinetobacter in Activated Sludge,
W87-02744 5D

PRINCETON UNIV., NJ. DEPT. OF CIVIL ENGINEERING.
Role of Detention Basins for Stormwater Quality Control,
W87-03301 5G

PRINCETON UNIV., NJ. WATER RESOURCES PROGRAM.
Hydrologic Similarity: 1. Derivation of the Dimensionless Flood Frequency Curve,
W87-03194 2E

PURDUE UNIV., LAFAYETTE, IN. DEPT. OF GEOSCIENCES.
Response of Cloud Supersaturation to Radiative Forcing,
W87-03214 2B

PURDUE UNIV., LAFAYETTE, IN. DEPT. OF HORTICULTURE.
Growth and Nutritional Status of Petunia and Tomato Seedlings with Acidified Irrigation Water,
W87-03105 5C

QUEBEC UNIV., RIMOUSKI. DEPT. OF OCEANOGRAPHY.
Early Diagenesis of Cadmium and Cobalt in Sediments of the Laurentian Trough,
W87-03138 5B

QUEBEC UNIV., SAINTE-FOY.
Functional Design of Activated Sludge Processes with Heavy Metal Inhibition,
W87-03131 5D

QUEBEC UNIV., TROIS-RIVIERES. CENTRE DE RECHERCHE EN PATES ET PAPIERS.
Mixed-Culture Microbial Protein from Waste Sulfite Pulping Liquor II: Its Production on a Pilot-Plant Scale and Use in Animal Feed,
W87-03132 5E

QUEENSLAND UNIV., BRISBANE (AUSTRALIA). DEPT. OF CHEMICAL ENGINEERING.
Ion Exchange Properties of Retorted Rundle Oil Shale,
W87-02707 5B

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Speciation of Manganese in Freshwaters,
W87-03051 2K

QUEENSLAND UNIV., BRISBANE (AUSTRALIA). DEPT. OF CIVIL ENGINEERING.
Simple Approximation for a Moving Interface in a Coastal Aquifer,
W87-02851 2F

RAJENDRA AGRICULTURAL UNIV., SAMASTIPUR (INDIA). DEPT. OF SOIL SCIENCE AND AGRICULTURAL CHEMISTRY.
Forms of Nitrogen in Waterlogged Soils and Their Contribution to Yield and Nitrogen Uptake by Rice,
W87-03158 3C

RAND AFRIKAANS UNIV., JOHANNESBURG (SOUTH AFRICA). FACULTY OF ENGINEERING.
Forecasting Sediment Distribution in Reservoirs During Unstable Conditions,
W87-02680 2J

REGENSBURG UNIV. (GERMANY, F.R.). INST. FUER ANORGANISCHE CHEMIE.
Determination of Lead, Cadmium and Thallium in Water Samples at ppb and ppt Levels by Isotope Dilution Mass Spectrometry, (Bestimmung von Blei, Cadmium und Thallium in Wasserproben im ppb- und ppt-Bereich durch massenspektrometrische Isotopenverdunnungsanalyse),
W87-02795 5A

RENSSELAER POLYTECHNIC INST., TROY, NY. DEPT. OF CHEMICAL AND ENVIRONMENTAL ENGINEERING.
Concentration of Seeded and Naturally Occurring Enteroviruses from Waters of Varying Quality by Hollow Fiber Ultrafiltration,
W87-02648 5A

RHODE ISLAND UNIV., KINGSTON. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Macrophyte Growth in Shallow Streams: Field Investigations,
W87-02887 5C

Macrophyte Growth in Shallow Streams: Biomass Model,
W87-02888 5C

ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION, TEMPE, AZ. FORESTRY SCIENCES LAB.
Designing for Dynamic Equilibrium in Streams,
W87-02929 2E

ROORKEE UNIV. (INDIA). DEPT. OF EARTH SCIENCES.
Aquifer Transmissivity of Porous Media from Resistivity Data,
W87-02837 7B

ROYAL DANISH SCHOOL OF PHARMACY, COPENHAGEN.
Validation of a Prognosis Based Upon a Eutrophication Model,
W87-02602 5C

RUTGERS - THE STATE UNIV., CAMDEN, NJ. DEPT. OF BIOLOGY.
Growth and Survival of Giant Ragweed (Ambrosia trifida L.) in a Delaware River Freshwater Tidal Wetland,
W87-03207 2H

RUTGERS - THE STATE UNIV., PISCATAWAY, NJ. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Unsaturated Flow Through Solid Waste Landfills: Model and Sensitivity Analysis,
W87-02628 5B

Modeling Leachate Production from Municipal Landfills,
W87-02883 5B

SAFEWAY STORES, INC., OAKLAND, CA.
Efficient Response Matrix Method for Coupling a Groundwater Simulator and a Regional Agricultural Management Model,
W87-02936 4B

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Classification of Drainage Basins According to their Physical Characteristics; An Application for Flood Frequency Analysis in Scotland,
W87-02683 2E

SALINA AREA VOCATIONAL-TECHNICAL SCHOOL, KS.
$5.00, 1-Minute Effluent Quality Tester,
W87-02814 7B

Measuring Sludge Concentration and Quality,
W87-02835 5D

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W87-03121 5D

SATEC LTD., CREWE (ENGLAND).
Biological Phosphorus and Nitrogen Removal at an Experimental Full Scale Plant in the U.K.,
W87-02750 5D

SATTERTHWAITE ASSOCIATES, INC., WEST CHESTER, PA.
Soil Potential Ratings for Onsite Wastewater Disposal,
W87-02860 5E

SCIENCE AND EDUCATION ADMINISTRATION, LINCOLN, NE
Physical Environment Near the Surface of Plowed and No-Tilled Soils,
W87-03171 2G

SCIENCE AND EDUCATION ADMINISTRATION, MANDAN, ND. NORTHERN GREAT PLAINS RESEARCH CENTER.
Estimation of Spring Wheat Spike Water Concentration and Grain Maturity from Air Temperature,
W87-02998 2I

SCIENCE UNIV. OF TOKYO (JAPAN).
Dewatering of Bottom Sediments,
W87-03261 2J

SCIENCE UNIV. OF TOKYO (JAPAN). DEPT. OF MANAGEMENT SCIENCE.
Interactive Algorithm for the Parameter Estimation of Complex Systems and Its Application to an Ecological Modelling of an Actual Japanese Lake,
W87-02600 2H

SEATTLE CITY LIGHT DEPT., WA.
Modeling North Cascades Annual Runoff Distribution Using Drainage Basin Elevation Distribution,
W87-02627 2E

SEATTLE DEPT. OF WATER, WA. WATER QUALITY DIV.
Managing an Unfiltered Water Supply,
W87-02609 5F

SERVICE DES MALADIES PARASITAIRES ET EXOTIQUES, ANGERS (FRANCE).
Sanitary Study of Surface Water and of the Beach of a Water Sports and Leisure Complex,
W87-02777 5B

SEVERN-TRENT WATER AUTHORITY (ENGLAND). REGIONAL LAB.
Detection of Enteroviruses: An Assessment of Ten Cell Lines,
W87-02651 5A

Failure to Detect Cytopathic Enteroviruses in Drinking Water,
W87-02654 5A

SHELLFISH RESEARCH LAB., CARNA (IRELAND).
Zooplankton Fauna of Killary Harbour: The Seasonal Cycle of Abundance,
W87-03054 2L

SLOTTA ENGINEERING ASSOCIATES, INC., CORVALLIS, OR.
Flow Processes of a Cutterhead Dredge,
W87-03262 8C

SMITH KLINE AND FRENCH LABS., PHILADELPHIA, PA.
HPLC Anion Exclusion Method for Fluoride Determinations in Complex Effluents,
W87-03094 5A

SOCIETE GRENOBLOISE D'ETUDES ET D'APPLICATIONS HYDRAULIQUES (FRANCE).
Taking Hydrology and Economic Factors into Account for Calculating the Economic Diameter of the Penstocks for High Head Micropower Plants, (Prise en Compte de l'Hydrologie et des Facteurs Economiques dans le Calcul du Diametre Economique des Conduites Forcees des Microcentrales Haute Chute),
W87-02568 8C

SOCIETE NATIONALE DE L'AMIANTE, SHERBROOK (QUEBEC).
Physiological Innocuity of Asbestos in Water,
W87-02831 5C

SOIL CONSERVATION SERVICE, COLUMBIA, MO.
Seasonal Sediment Yield to Mark Twain Lake, Missouri,
W87-02789 2J

SOUTHAMPTON UNIV. (ENGLAND). DEPT. OF MECHANICAL ENGINEERING.
Improved Monitoring of Air in Water,
W87-03038 7B

SOUTHERN ILLINOIS UNIV. AT CARBONDALE. DEPT. OF GEOGRAPHY.
Minimizing the Cost of Coping with Droughts: Springfield, Illinois,
W87-03057 6D

SPLIT UNIV. (YUGOSLAVIA). FACULTY OF CIVIL ENGINEERING SCIENCES.
Hydrological Investigations of Dinaric Karst at the Krcic Catchment and the River Krka Springs (Yugoslavia),
W87-02845 2A

SRI LANKA UNIV., PERADENIYA. DEPT. OF GEOLOGY.
Groundwater Occurrences in the Hard Rock Terrains of Sri Lanka - A Case Study,
W87-03047 2F

SRI LANKA UNIV., PERADENIYA. ENVIRONMENTAL GEOCHEMISTRY RESEARCH GROUP.
Environmental Chemistry of Rainwater in Sri Lanka,
W87-03023 2B

Chemistry of Tap Water in Sri Lanka - Implications on Health,
W87-03026 5F

STICHTING VOOR BODEMKARTERING, WAGENINGEN (NETHERLANDS).
Procedure to Identify Different Groups of Hydraulic-Conductivity and Moisture-Retention Curves for Soil Horizons,
W87-03075 2G

STOCKHOLM UNIV. (SWEDEN). METEOROLOGISKA INSTITUTIONEN.
Deposition of Atmospheric Trace Metals in Northern Sweden as Measured in the Snowpack,
W87-02720 5B

Temporal Evolution of Nitrogen Compounds in Swedish Precipitation Since 1955,
W87-02812 2B

SUFFOLK COUNTY DEPT. OF PUBLIC HEALTH, HAUPPAUGE, NY.
Groundwater Contamination with Synthetic Organic Compounds and Pesticides in Suffolk County,
W87-02827 5B

SULZER-ESCHER WYSS LTD., ZURICH (SWITZERLAND).
Large Pelton Turbines for Canada's Cat Arm Scheme,
W87-02688 8C

SURREY UNIV., GUILDFORD (ENGLAND). DEPT. OF MICROBIOLOGY.
Electrofocusing of Viruses and Sensitivity to Disinfection,
W87-02664 5D

TATMAN AND LEE ASSOCIATES, WILMINGTON, DE.
Pump Station Gets Navy Discharge and New Life as Civilian,
W87-02925 5F

TECHNICAL UNIV. OF DENMARK, LYNGBY. DEPT. OF SANITARY ENGINEERING.
Exchange of Organics, Phosphate and Cations between Sludge and Water in Biological Phosphorus and Nitrogen Removal Processes,
W87-02745 5D

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Bed Friction and Dissipation in a Combined Current and Wave Motion,
W87-03210 8B

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Concentration of Viruses from Water Using Pig Erythrocyte Ghost Cells,
W87-02650 5A

TECHNION - ISRAEL INST. OF TECH., HAIFA. FACULTY OF CIVIL ENGINEERING.
Single-sludge Nitrogen Removal: Modeling and Experimental Results,
W87-02823 5D

TECHNISCHE UNIV. HAMBURG-HARBURG (GERMANY, F.R.). ARBEITSBEREICH UMWELTSCHUTZTECHNIK.
Direct Determination of Cd, Cu and Ni in the Elbe River Estuary with Zeeman AAS and Matrix Modification (Direktbestimmung von Cd, Cu and Ni im Elbeastuar mit Hilfe der Zeeman-Atomabsorptionsspektroskopie und Matrixmodifikation),
W87-03087 5A

TEMPLE UNIV., PHILADELPHIA, PA. SCHOOL OF LAW.
Abstention: The Crooked Course of Colorado River,
W87-02596 6E

TENNESSEE UNIV., KNOXVILLE.
Estimating Macroporosity in a Forest Watershed by use of a Tension Infiltrometer,
W87-02917 2G

TEXACO, INC., BEACON, NY.
Environmental Impact of Oil Spills and the Oil Industry Response,
W87-02829 5C

TEXAS A AND M UNIV., COLLEGE STATION.
Turfgrass Water Use Rates,
W87-03014 2I

Controlling Turfgrass Water Use Rates,
W87-03017 2I

TEXAS A AND M UNIV., COLLEGE STATION. CENTER FOR ENERGY AND MINERAL RESOURCES.
Health Effects of Arsenic in the Aqueous Environment,
W87-02833 5C

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Rate of Water Loss from Detached Leaves of Drought Resistant and Susceptible Genotypes of Cowpea,
W87-02960 2I

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF PHYSICS.
Nursery Irrigation-Syringe System That Monitors Environmental Parameters,
W87-03107 7C

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF SOIL AND CROP SCIENCES.
Resistance of Plant Roots to Water Loss,
W87-03005 2I

Hazardout Waste Disposal: What Are the Options,
W87-03015 5E

Under EPA Scrutiny: Underground Storage Tanks,
W87-03021 5B

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Spatial Variability and Soil Sampling for Salinity and Sodicity Appraisal in Surface Irrigated Orchards,
W87-02726 2G

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Effects of Pattern and Amount of Simulated Rainfall on Seedling Dynamics of Weeping Lovegrass and Kleingrass,
W87-03011 2I

TEXAS UNIV. AT DALLAS, RICHARDSON. GRADUATE PROGRAM IN ENVIRONMENTAL SCIENCES.
Diel Variation of In-stream Nitrification,
W87-02711 5B

TEXAS UNIV. MEDICAL SCHOOL AT HOUSTON.
Detection of Rotavirus in Treated Drinking Water,
W87-02643 5B

THAMES WATER AUTHORITY, LONDON (ENGLAND).
Viruses and Bacteria in a Chalk Well,
W87-02655 5B

THESSALONIKI UNIV., SALONIKA (GREECE). DEPT. OF HYDRAULICS.
Mathematical Prediction of Thermal Stratification of Lake Ostrovo (Vegoritis), Greece,
W87-03198 2H

TOHOKU UNIV., SENDAI (JAPAN). DEPT. OF CIVIL ENGINEERING.
Effect of Seawater on Nitrification by Attached Biofilm,
W87-02603 5D

Study of Dissolved Oxygen Budgets in Natural and Artificial Lakes,
W87-02976 2H

TOKYO UNIV. (JAPAN). DEPT. OF URBAN AND SANITARY ENGINEERING.
Behaviour of Intracellular Polyphosphate in the Biological Phosphate Removal Process,
W87-02735 5D

TOKYO UNIV. (JAPAN). DEPT. OF URBAN ENGINEERING.
Modeling for Estimating Representative Water Conditions in a River Basin,
W87-02604 5B

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Stability of Flows in Channels with Small Wall Curvature,
W87-02863 8B

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Meteorological Data Analysis for Drainage System Design,
W87-02882 2B

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Decomposition Studies in Two Central Ontario Lakes Having Surficial pHs of 4.6 and 6.6,
W87-02897 2H

ULM UNIV. (GERMANY, F.R.). ABT. ANALYTISCHE CHEMIE.
Flow Injection Analysis of Chloride in Tap and Sewage Water Using Ion-Selective Electrode Detection,
W87-02798 5A

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Getting Your Money's Worth from Computer Based Control Systems - Part 1,
W87-03120 5D

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Response to Waterlogging and Differing Sensitivity to Divalent Iron and Manganese in Clones of Dactylis glomerata L. Derived from Well-Drained and Poorly-Drained Soils,
W87-03095 5C

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Lake Acidification and the Land-Use Hypothesis: A Mid-Post-Glacial Analogue,
W87-02810 2K

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Salt Tolerance in the Triticeae: Salinity-Induced Changes in the Leaf Solute Composition of Some Perennial Triticeae,
W87-02785 2I

UNIVERSITY OF CENTRAL FLORIDA, ORLANDO. DEPT. OF CIVIL ENGINEERING AND ENVIRONMENTAL SCIENCES.
Nutrient Transformation in Retention/Detention Ponds Receiving Highway Runoff,
W87-02821 5D

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Modelling of Industrial Ecological Systems for Evaluation of Health Services,
W87-02979 4C

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Acyclic Archaebacterial Ether Lipids in Swamp Sediments,
W87-03141 5A

UNIVERSITY OF SOUTHERN CALIFORNIA, LOS ANGELES. DEPT. OF GEOGRAPHY.
Voter Reactions to the 1976 Water Development and Quality Referenda in Texas,
W87-02944 6E

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Direct Solutions for Normal Depth Using the Manning Equation,
W87-02963 2E

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Real-Time Kinematic Catchment Model for Hydro Operation,
W87-02766 2E

Explicit Solution of the Modified Horton Equation,
W87-02850 2G

UTAH WATER RESEARCH LAB., LOGAN.
Risk Information for Floodplain Management,
W87-03061 6F

UTRECHT RIJKSUNIVERSITEIT (NETHERLANDS). DEPT. OF GEOGRAPHY.
Budget of Water and Its Constituents for Lake Taupo (New Zealand),
W87-03295 2H

UTRECHT RIJKSUNIVERSITEIT (NETHERLANDS). DEPT. OF PHYSICAL GEOGRAPHY.
Algorithm for Computing the Relationship between Diffusivity and Soil Moisture Content from the Hot Air Method,
W87-02856 2G

VALTION TEKNILLINEN TUTKIMUSKESKUS, ESPOO (FINLAND). REAKTORILABORATORIO.
Three-dimensional Water-Quality-Transport Model Compared with Field Observations,
W87-02970 2H

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Solute Yield From a Glacierized High Mountain Basin,
W87-03276 5B

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Radiation Induced Decomposition of Some Chlorinated Methanes in Water,
W87-02702 5D

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Detection of Hepatitis A Virus in Drinking Water by Enzyme-Immunoassay Using Ultracentrifugation for Virus Concentration,
W87-02647 5A

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Thermodynamic Study of Solutions of Liquid Hydrocarbon Mixtures in Water,
W87-03145 1B

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W87-02698 5C

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF AGRONOMY.
Characterization and Classification of Seaside-Salt-marsh Soils on Virginia's Eastern Shore,
W87-02919 2L

VIRGINIA POLYTECHNIC INST. AND STATE UNIV., BLACKSBURG. DEPT. OF CIVIL ENGINEERING.
Biodegradation of Methanol and Tertiary Butyl Alcohol in Subsurface Systems,
W87-02732 5B

VIRGINIA UNIV., CHARLOTTESVILLE. DEPT. OF ENVIRONMENTAL SCIENCES.
Distribution Function Approach to Water Flow in Soil Macropores Based on Kinematic Wave Theory,
W87-02858 2G

VIZGAZDALKODASI TUDOMANYOS KUTATO INTEZET, BUDAPEST (HUNGARY).
Multivariate Analysis of Quality Parameters to Determine the Chemical Transport in Rivers,
W87-03280 5B

Principles Underlying the Development of Water Quality Monitoring Systems in Hungary,
W87-03303 7A

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Stochastic Approach to the Crop Yield-Irrigation Relationships in Heterogeneous Soils: I. Analysis of the Field Spatial Variability,
W87-02921 3F

Stochastic Approach to the Crop Yield-Irrigation Relationships in Heterogeneous Soils: II. Application to Irrigation Management,
W87-02922 3F

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Chemical Mass Balance of a Small Basin in a Wet Monsoonal Environment and the Effect of Fast-Growing Plantation Forest,
W87-03291 2H

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Real Time Water Quality Forecasting Models Based on the Water Quantity/Quality Relationship,
W87-03304 5A

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Self-closing Cylindrical Gate Improves Safety at Low Cost,
W87-02693 8C

Microbial Polymers in the Aquatic Environment-I: Production by Activated Sludge Microorganisms under Different Conditions,
W87-02694 5D

Microbial Polymers in the Aquatic Environment-II: Isolation from Biologically Non-purified and Purified Municipal Waste Water and Analysis,
W87-02695 5D

WAHNBACHTALSPERRENVERBAND, SIEGBURG (GERMANY, F.R.).
Runoff Processes and Dissolved Substances During Flood Events in Small Differently Used Drainage Areas,
W87-03283 2E

WARD (FREDERICK) AND ASSOCIATES, INC., BEL AIR, MD.
County's Search for Long-Term Water Supply Pays Off,
W87-03119 5F

WASHINGTON STATE UNIV., PULLMAN.
Responses of Sugarbeet to Deficit, High-Frequency Sprinkler Irrigation. I. Sucrose Accumulation, and Top and Root Dry Matter Production,
W87-02985 3F

Responses of Sugarbeet to Deficit, High-Frequency Sprinkler Irrigation. II. Sugarbeet Development and Partitioning to Root Growth,
W87-02986 3F

WASHINGTON STATE UNIV., PULLMAN. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Stream Improvements and Fish Response: A Bio-engineering Assessment,
W87-02932 4A

WASHINGTON STATE UNIV., WENATCHEE. TREE FRUIT RESEARCH CENTER.
Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. I. Soil Moisture, Water Relations, Tree and Fruit Growth,
W87-03110 3F

Seasonal Response of 'Anjou' Pear Trees to Different Irrigation Regimes. II. Mineral Composition of Fruit and Leaves, Fruit Disorders, and Fruit Set,
W87-03111 3F

WASHINGTON SUBURBAN SANITARY COMMISSION, HYATTSVILLE, MD.
Maryland's Phosphate Ban-History and Early Results,
W87-02819 5G

WASHINGTON UNIV., SEATTLE. DEPT. OF CIVIL ENGINEERING.
Complexity in Columbia River Systems Modeling,
W87-03059 6B

Drought and Power Production,
W87-03060 6D

WASHINGTON UNIV., SEATTLE. SCHOOL OF OCEANOGRAPHY.
Arsenic Distributions in Porewaters and Sediments of Puget Sound, Lake Washington, the Washington Coast and Saanich Inlet, B.C.,
W87-03133 5B

WATER RESEARCH CENTRE, MEDMENHAM (ENGLAND). MEDMENHAM LAB.
Manurial Value of Septic-Tank Sludge on Grassland,
W87-03102 5E

WATERLOO UNIV. (ONTARIO).
Wildland Management on Point Pelee, Rondeau, and Long Point Peninsulas, Lake Erie,
W87-02591 6G

WATERLOO UNIV. (ONTARIO). DEPT. OF CIVIL ENGINEERING.
Analysis of Stochastic Groundwater Problems. Part I: Deterministic Partial Differential Equations in Groundwater Flow. A Functional-Analytic Approach,
W87-02842 2F

Analysis of Stochastic Groundwater Flow Problems. Part II: Stochastic Partial Differential Equations in Groundwater Flow. A Functional-Analytic Approach,
W87-02843 2F

Analysis of Stochastic Groundwater Flow Problems. Part III: Approximate Solution of Stochastic Partial Differential Equations,
W87-02844 2F

WATERLOO UNIV. (ONTARIO). DEPT. OF EARTH SCIENCES.
137C-135C Variations in a Diffusion-Controlled Groundwater System,
W87-03149 5A

WATERLOO UNIV. (ONTARIO). DEPT. OF SYSTEMS DESIGN ENGINEERING.
Application of Computer Intensive Statistics to Parameter Uncertainty in Streamflow Synthesis,
W87-02945 2E

WATERMEYER, LEGGE, PIESOLD AND UHLMANN, ASHFORD (ENGLAND).
Cordless Geo-Data Link,
W87-03031 7B

WEIZMANN INST. OF SCIENCE, REHOVOTH (ISRAEL). DEPT. OF ISOTOPE RESEARCH.
Tritium Corrected 14C and Atmospheric Noble Gas Corrected 4He Applied to Deduce Ages of Mixed Groundwaters: Examples from the Baden Region, Switzerland,
W87-03147 5A

WELSH PLANT BREEDING STATION, ABERYSTWYTH.
Relationships Between Growth and Measured Weather Factors Among Contrasting Varieties of Lolium, Dactylis and Festuca Species,
W87-03100 2I

WEST OF SCOTLAND AGRICULTURAL COLL., AUCHINCRUIVE.
Microclimate of an Upland Grassland,
W87-03101 2I

WEST VIRGINIA UNIV., MORGANTOWN. DIV. OF PLANT AND SOIL SCIENCES.
Correlation of Metal-Organic Fractions with Soil Properties in Sewage-Sludge-Amended Soils,
W87-02714 5E

WESTFIELD COLL., LONDON (ENGLAND). DEPT. OF BOTANY AND BIOCHEMISTRY.
Underwater Light Climate and the Growth and Pigmentation of Planktonic Blue-Green Algae (Cyanobacteria) I. The Influence of light quantity,
W87-02908 2H

Underwater Light Climate and the Growth and Pigmentation of Planktonic Blue-green Algae (Cyanobacteria) II. the Influence of Light Quality,
W87-02909 2H

WESTINGHOUSE ELECTRIC CORP., HORSEHEADS, NY. INDUSTRY AND GOVERNMENT TUBE DIV.
Borehole Television for Geotechnical Investigations,
W87-03032 7B

WHEATON SANITARY DISTRICT, IL.
Dual-use Filters Keep Wet-weather Flows Under Control,
W87-02926 5D

WINDSOR UNIV. (ONTARIO). DEPT. OF CIVIL ENGINEERING.
Erosion of Unconsolidated Gravel Beds,
W87-02673 2J

Design Factors for the Scouring of Deposited Materials in Water and Wastewater Treatment Systems,
W87-02674 5F

WISCONSIN STATE LAB. OF HYGIENE, MADISON.
Effect of Influent Phosphorus Reductions on Great Lakes Sewage Treatment Costs,
W87-02630 5D

WISCONSIN UNIV.-LA CROSSE. RIVER STUDIES CENTER.
Effects of Disturbance on Epiphytic Community Architecture,
W87-02806 2H

WISCONSIN UNIV.-MADISON.
Peroxide Coated Seed Emergence in Water-Saturated Soil,
W87-03009 2I

WISCONSIN UNIV.-MADISON. DEPT. OF HORTICULTURE.
Response of Lettuce Cultivars to Sludge-Amended Soils and Bed Types,
W87-02880 3C

WISCONSIN UNIV.-MADISON. DEPT. OF SOIL SCIENCE.
Sources of Nitrate to Ground Water,
W87-03130 5B

WOODWARD-CLYDE CONSULTANTS, ENGLEWOOD, CO.
Regional Analysis of Water Quality in Major Streams of the United States,
W87-03284 5G

WYOMING UNIV., LARAMIE. DEPT. OF ECONOMICS.
Existence Values and Normative Economics: Implications for Valuing Water Resources,
W87-03188 6B

WYOMING UNIV., LARAMIE. DEPT. OF MATHEMATICS.
Finite-Element Collocation Method for Variably Saturated Flow in Two Space Dimensions,
W87-03192 2F

YALE UNIV., NEW HAVEN, CT. SCHOOL OF FORESTRY AND ENVIRONMENTAL STUDIES.
Transport and Loss of Nitrous Oxide in Soil Water After Forest Clear-cutting,
W87-02912 5B

YAMAGUCHI UNIV. (JAPAN). DEPT. OF CIVIL ENGINEERING.
Study on Chemical Behavior Between Sediment and Upper Water,
W87-03251 2J

YAMAGUCHI UNIV. (JAPAN). DIV. OF SANITARY ENGINEERING.
Study on the Modelling of the Behavior of Phosphorus Released from Sediments,
W87-02967 2L

YARMOUK UNIV., IRBID (JORDAN). DEPT. OF CIVIL ENGINEERING.
Computerized Layout Generation for Sanitary Sewers,
W87-03062 8A

ZURICH UNIV. (SWITZERLAND). INST. OF VIROLOGY.
Method for Determining Virus Inactivation During Sludge Treatment Processes,
W87-02898 5A

ACCESSION NUMBER INDEX

W87-02562 5B
W87-02563 5B
W87-02564 5B
W87-02565 3F
W87-02566 8C
W87-02567 8C
W87-02568 8C
W87-02569 8C
W87-02570 8C
W87-02571 8C
W87-02572 8C
W87-02573 8C
W87-02574 8C
W87-02575 8C
W87-02576 8C
W87-02577 8C
W87-02578 8C
W87-02579 8C
W87-02580 8C
W87-02581 8C
W87-02582 5A
W87-02583 5B
W87-02584 5B
W87-02585 5B
W87-02586 5A
W87-02587 5B
W87-02588 5B
W87-02589 5C
W87-02590 6E
W87-02591 6G
W87-02592 6E
W87-02593 6E
W87-02594 6E
W87-02595 6E
W87-02596 6E
W87-02597 2L
W87-02598 7A
W87-02599 7C
W87-02600 2H
W87-02601 2L
W87-02602 5C
W87-02603 5D
W87-02604 5B
W87-02605 5F
W87-02606 6C
W87-02607 5B
W87-02608 5G
W87-02609 5F
W87-02610 5F
W87-02611 5F
W87-02612 5C
W87-02613 5F
W87-02614 5B
W87-02615 2H
W87-02616 6E
W87-02617 6D
W87-02618 5G
W87-02619 6E
W87-02620 5B
W87-02621 6G
W87-02622 4D
W87-02623 2B
W87-02624 4B
W87-02625 5B
W87-02626 6A
W87-02627 2E
W87-02628 5B
W87-02629 6A
W87-02630 5D
W87-02631 5B
W87-02632 9D
W87-02633 6A
W87-02634 6A
W87-02635 5G
W87-02636 5G
W87-02637 6E
W87-02638 6E
W87-02639 5B
W87-02640 2C
W87-02641 5E
W87-02642 5G
W87-02643 5B
W87-02644 5G
W87-02645 5A
W87-02646 5A
W87-02647 5A
W87-02648 5A
W87-02649 5A
W87-02650 5A
W87-02651 5A
W87-02652 5A
W87-02653 5A
W87-02654 5A
W87-02655 5B
W87-02656 5A
W87-02657 5B
W87-02658 5D
W87-02659 5B
W87-02660 5D
W87-02661 5D
W87-02662 5B
W87-02663 5B
W87-02664 5D
W87-02665 5F
W87-02666 5D
W87-02667 2C
W87-02668 8B
W87-02669 2E
W87-02670 5D
W87-02671 2E
W87-02672 5B
W87-02673 2J
W87-02674 5F
W87-02675 2E
W87-02676 2F
W87-02677 2F
W87-02678 7B
W87-02679 2D
W87-02680 2J
W87-02681 2E
W87-02682 5G
W87-02683 2E
W87-02684 2E
W87-02685 2G
W87-02686 2F
W87-02687 8C
W87-02688 8C
W87-02689 8A
W87-02690 8C
W87-02691 8C
W87-02692 8D
W87-02693 8C
W87-02694 5D
W87-02695 5D
W87-02696 5B
W87-02697 5C
W87-02698 5C
W87-02699 5C
W87-02700 5A
W87-02701 5A
W87-02702 5D
W87-02703 5D
W87-02704 5D
W87-02705 5D
W87-02706 5D
W87-02707 5B
W87-02708 5F
W87-02709 5D
W87-02710 5A
W87-02711 5B
W87-02712 2G
W87-02713 2G
W87-02714 5E
W87-02715 2G
W87-02716 5B
W87-02717 2I
W87-02718 2I
W87-02719 5B
W87-02720 5B
W87-02721 5B
W87-02722 5B
W87-02723 2G
W87-02724 2G
W87-02725 2G
W87-02726 2G
W87-02727 2G
W87-02728 2G
W87-02729 5B
W87-02730 5B
W87-02731 5B
W87-02732 5B
W87-02733 5B
W87-02734 5G
W87-02735 5D
W87-02736 5D
W87-02737 5D
W87-02738 5D
W87-02739 5D
W87-02740 5D
W87-02741 5D
W87-02742 5D
W87-02743 5D
W87-02744 5D
W87-02745 5D
W87-02746 5D
W87-02747 5D
W87-02748 5D
W87-02749 5D
W87-02750 5D
W87-02751 5D
W87-02752 5D
W87-02753 5D
W87-02754 5G
W87-02755 5F
W87-02756 6D
W87-02757 5G
W87-02758 2L
W87-02759 5B
W87-02760 3F
W87-02761 3F
W87-02762 8B
W87-02763 5B
W87-02764 5B
W87-02765 5E
W87-02766 2E
W87-02767 8I
W87-02768 5B
W87-02769 2I
W87-02770 8F
W87-02771 5C
W87-02772 2H
W87-02773 2J
W87-02774 5B
W87-02775 5E
W87-02776 2L
W87-02777 5B
W87-02778 5C
W87-02779 5F
W87-02780 2H
W87-02781 5D
W87-02782 6F
W87-02783 5D
W87-02784 5G
W87-02785 2I
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W87-02789 2J
W87-02790 8B
W87-02791 5B
W87-02792 5C
W87-02793 5A
W87-02794 5A
W87-02795 5A
W87-02796 5A
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W87-02799 5A
W87-02800 5B
W87-02801 5B
W87-02802 5A
W87-02803 5A
W87-02804 5A
W87-02805 2L
W87-02806 2H
W87-02807 2L
W87-02808 2H
W87-02809 2L
W87-02810 2K
W87-02811 2B
W87-02812 2B
W87-02813 2I
W87-02814 7B
W87-02815 5D
W87-02816 2I
W87-02817 2I
W87-02818 5A
W87-02819 5G
W87-02820 5D
W87-02821 5D
W87-02822 5G
W87-02823 5D
W87-02824 5G
W87-02825 5C
W87-02826 5C
W87-02827 5B
W87-02828 5G
W87-02829 5C
W87-02830 5C
W87-02831 5C
W87-02832 5B
W87-02833 5C
W87-02834 5D
W87-02835 5D
W87-02836 5B
W87-02837 7B
W87-02838 2F
W87-02839 5B
W87-02840 2F
W87-02841 2E
W87-02842 2F
W87-02843 2F
W87-02844 2F
W87-02845 2A
W87-02846 2G
W87-02847 5A
W87-02848 2F
W87-02849 2F
W87-02850 2G
W87-02851 2F
W87-02852 2F
W87-02853 2A
W87-02854 7B
W87-02855 2E
W87-02856 2G
W87-02857 2G
W87-02858 2G
W87-02859 2F
W87-02860 5E
W87-02861 2G
W87-02862 2E
W87-02863 8B
W87-02864 8A
W87-02865 8D
W87-02866 8A
W87-02867 8A
W87-02868 8B
W87-02869 8A
W87-02870 8A
W87-02871 8D
W87-02872 6D
W87-02873 3F
W87-02874 6C
W87-02875 3F
W87-02876 3F
W87-02877 3F
W87-02878 3F
W87-02879 3F
W87-02880 3C
W87-02881 3F
W87-02882 2B
W87-02883 5B
W87-02884 5D
W87-02885 5B
W87-02886 8B
W87-02887 5C
W87-02888 5C
W87-02889 5B
W87-02890 5A
W87-02891 5B
W87-02892 5A
W87-02893 5B
W87-02894 5A
W87-02895 5B
W87-02896 5A

W87-02897 2H
W87-02898 5A
W87-02899 5B
W87-02900 5A
W87-02901 5C
W87-02902 5A
W87-02903 5D
W87-02904 8A
W87-02905 5D
W87-02906 1B
W87-02907 5B
W87-02908 2H
W87-02909 2H
W87-02910 2G
W87-02911 2G
W87-02912 5B
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W87-02914 2G
W87-02915 2G
W87-02916 2F
W87-02917 2G
W87-02918 5B
W87-02919 2L
W87-02920 3F
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W87-02924 3F
W87-02925 5F
W87-02926 5D
W87-02927 8C
W87-02928 8C
W87-02929 2E
W87-02930 2J
W87-02931 4A
W87-02932 4A
W87-02933 6D
W87-02934 4A
W87-02935 4A
W87-02936 4B
W87-02937 6E
W87-02938 3F
W87-02939 5C
W87-02940 6E
W87-02941 5B
W87-02942 2F
W87-02943 5B
W87-02944 6E
W87-02945 2E
W87-02946 3F
W87-02947 3F
W87-02948 3F
W87-02949 7B
W87-02950 7B
W87-02951 2I
W87-02952 2I
W87-02953 7B
W87-02954 3C
W87-02955 3C
W87-02956 3F
W87-02957 3F
W87-02958 3C
W87-02959 3F
W87-02960 2I
W87-02961 2I
W87-02962 2I
W87-02963 2E
W87-02964 5B
W87-02965 2H
W87-02966 3F
W87-02967 2L
W87-02968 5C
W87-02969 2L
W87-02970 2H
W87-02971 2H
W87-02972 2H
W87-02973 5G
W87-02974 2E
W87-02975 5B
W87-02976 2H
W87-02977 5F
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W87-02979 4C
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W87-02981 3F
W87-02982 2G
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W87-02986 3F
W87-02987 3F
W87-02988 3C
W87-02989 2I
W87-02990 2C
W87-02991 2I
W87-02992 2I
W87-02993 3F
W87-02994 2I
W87-02995 3F
W87-02996 3C
W87-02997 3F
W87-02998 2I
W87-02999 2I
W87-03000 2I
W87-03001 2I
W87-03002 2I
W87-03003 3C
W87-03004 3F
W87-03005 2I
W87-03006 2I
W87-03007 2I
W87-03008 2I
W87-03009 2I
W87-03010 2I
W87-03011 2I
W87-03012 2I
W87-03013 2I
W87-03014 2I
W87-03015 5E
W87-03016 2I
W87-03017 2I
W87-03018 4A
W87-03019 2I
W87-03020 2G
W87-03021 5B
W87-03022 5B
W87-03023 2B
W87-03024 5G
W87-03025 2H
W87-03026 5F
W87-03027 2L
W87-03028 5B
W87-03029 5D
W87-03030 5A
W87-03031 7B
W87-03032 7B
W87-03033 8C
W87-03034 8B
W87-03035 8C
W87-03036 8A
W87-03037 8E
W87-03038 7B
W87-03039 5F
W87-03040 5G
W87-03041 5F
W87-03042 5F
W87-03043 2F
W87-03044 5F
W87-03045 5F
W87-03046 5F
W87-03047 2F
W87-03048 5A
W87-03049 5A
W87-03050 5A
W87-03051 2K
W87-03052 5A
W87-03053 5C
W87-03054 2L
W87-03055 2I
W87-03056 2I
W87-03057 6D
W87-03058 6B
W87-03059 6B
W87-03060 6D
W87-03061 6F
W87-03062 8A
W87-03063 8A
W87-03064 6D
W87-03065 5G
W87-03066 6G
W87-03067 2E
W87-03068 5C
W87-03069 2L
W87-03070 7B
W87-03071 2E
W87-03072 4C
W87-03073 7B
W87-03074 2G
W87-03075 2G
W87-03076 2F
W87-03077 2F
W87-03078 5D
W87-03079 3A
W87-03080 5D
W87-03081 5C
W87-03082 2H
W87-03083 5C
W87-03084 5F
W87-03085 5B
W87-03086 5A
W87-03087 5A
W87-03088 5D
W87-03089 5B
W87-03090 5B
W87-03091 8A
W87-03092 5C
W87-03093 3C
W87-03094 5A
W87-03095 5C
W87-03096 2L
W87-03097 2H
W87-03098 6A
W87-03099 5E
W87-03100 2I
W87-03101 2I
W87-03102 5E
W87-03103 3F
W87-03104 2I
W87-03105 5C
W87-03106 3F
W87-03107 7C
W87-03108 3F
W87-03109 3F
W87-03110 3F
W87-03111 3F
W87-03112 5F
W87-03113 5A
W87-03114 5A
W87-03115 5A
W87-03116 5D
W87-03117 5A
W87-03118 4C
W87-03119 5F
W87-03120 5D
W87-03121 5D
W87-03122 6E
W87-03123 2E
W87-03124 5D
W87-03125 8A
W87-03126 5G
W87-03127 5C
W87-03128 2L
W87-03129 3C
W87-03130 5B
W87-03131 5D
W87-03132 5E
W87-03133 5B
W87-03134 5B
W87-03135 5E
W87-03136 5A
W87-03137 5B
W87-03138 5B
W87-03139 5B
W87-03140 5B
W87-03141 5A
W87-03142 5A
W87-03143 5B
W87-03144 5B
W87-03145 1B
W87-03146 2K
W87-03147 5A
W87-03148 5A
W87-03149 5A
W87-03150 2I
W87-03151 5C
W87-03152 5C
W87-03153 5C
W87-03154 5C
W87-03155 5C
W87-03156 5C
W87-03157 2I
W87-03158 3C
W87-03159 3F
W87-03160 2J
W87-03161 5B
W87-03162 2G
W87-03163 3F
W87-03164 2I
W87-03165 3F
W87-03166 3F
W87-03167 3F
W87-03168 3F
W87-03169 3F
W87-03170 3F
W87-03171 2G
W87-03172 5A
W87-03173 5A
W87-03174 5C
W87-03175 5C
W87-03176 8C
W87-03177 8C
W87-03178 8C
W87-03179 8C
W87-03180 8E
W87-03181 8E
W87-03182 8C
W87-03183 8D
W87-03184 8A
W87-03185 8A
W87-03186 8E
W87-03187 2F
W87-03188 6B
W87-03189 3F
W87-03190 6D
W87-03191 2G
W87-03192 2F
W87-03193 2F
W87-03194 2E
W87-03195 2J
W87-03196 5B
W87-03197 2F
W87-03198 2H
W87-03199 2F
W87-03200 2E
W87-03201 2F
W87-03202 2I
W87-03203 2L
W87-03204 2H
W87-03205 5C
W87-03206 5C
W87-03207 2H
W87-03208 2H
W87-03209 8E
W87-03210 8B
W87-03211 2L
W87-03212 2H
W87-03213 2B
W87-03214 2B
W87-03215 2B
W87-03216 2I
W87-03217 8B
W87-03218 8B
W87-03219 8A
W87-03220 2J
W87-03221 8A
W87-03222 8B
W87-03223 8A
W87-03224 8A
W87-03225 8A
W87-03226 6D
W87-03227 5C
W87-03228 5G
W87-03229 6B
W87-03230 5G
W87-03231 5G

W87-03232 5G
W87-03233 8A
W87-03234 5G
W87-03235 5G
W87-03236 5G
W87-03237 8A
W87-03238 5G
W87-03239 5G
W87-03240 8B
W87-03241 8B
W87-03242 5G
W87-03243 8A
W87-03244 5G
W87-03245 8A
W87-03246 6B
W87-03247 8A
W87-03248 5G
W87-03249 5G
W87-03250 5B
W87-03251 2J
W87-03252 5E
W87-03253 5B
W87-03254 5B
W87-03255 5B
W87-03256 5D
W87-03257 5C
W87-03258 2J
W87-03259 5E
W87-03260 8D
W87-03261 2J
W87-03262 8C
W87-03263 5E
W87-03264 5D
W87-03265 5G
W87-03266 5G
W87-03267 5E
W87-03268 5E
W87-03269 5B
W87-03270 5B
W87-03271 5G
W87-03272 5B
W87-03273 5B
W87-03274 5B
W87-03275 2E
W87-03276 5B
W87-03277 5B
W87-03278 5G
W87-03279 5B
W87-03280 5B
W87-03281 5B
W87-03282 5G
W87-03283 2E
W87-03284 5G
W87-03285 2E
W87-03286 5B
W87-03287 2B
W87-03288 2K
W87-03289 2J
W87-03290 5B
W87-03291 2H
W87-03292 2E
W87-03293 5B
W87-03294 2K
W87-03295 2H
W87-03296 5B
W87-03297 6G
W87-03298 2H
W87-03299 5B
W87-03300 6G
W87-03301 5G
W87-03302 5B
W87-03303 7A
W87-03304 5A
W87-03305 5C
W87-03306 2H
W87-03307 2E
W87-03308 6E
W87-03309 2F
W87-03310 6E
W87-03311 6E
W87-03312 6E
W87-03313 6E
W87-03314 6E
W87-03315 6E
W87-03316 3D
W87-03317 8A
W87-03318 8G
W87-03319 8F
W87-03320 8A
W87-03321 6G
W87-03322 7C
W87-03323 4D
W87-03324 5A
W87-03325 2F
W87-03326 2H
W87-03327 2B
W87-03328 6G
W87-03329 6G
W87-03330 6F
W87-03331 6B
W87-03332 5G
W87-03333 8B
W87-03334 8B
W87-03335 8B
W87-03336 2C
W87-03337 7B
W87-03338 5C
W87-03339 5E
W87-03340 5F

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A02	9.95	E02	10.00	B02	75.00	T02	175.00		
A03	11.95	E03	11.00	B03	125.00	T03	300.00		
A04-A05	13.95	E04	13.50	B04	175.00	T04	400.00		
A06-A09	18.95	E05	15.50	B05	225.00	T05	500.00		
A10-A13	24.95	E06	18.00	B06	275.00	T06	600.00		
A14-A17	30.95	E07	20.50	B07	325.00	T07	700.00		
A18-A21	36.95	E08	23.00	B08	375.00	T08	800.00		
A22-A25	42.95	E09	25.50	B09	425.00	T09	900.00		
A99	*	E10	28.00	B10	475.00	T10	1,000.00		
		E11	30.50	B11	525.00	T11	1,100.00		
		E12	33.00	B12	575.00	T12	1,200.00		
M01	4.50	E13	35.50	B13	625.00	T13	1,300.00		
M02	4.00	E14	38.50	B14	675.00	T14	1,400.00		
		E15	42.00	B15	725.00	T15	1,500.00		
		E16	46.00	B16	775.00	T16	1,600.00		
		E17	50.00	B17	825.00	T17	1,700.00		
		E18	54.00	B18	875.00	T18	1,800.00		
		E19	60.00	B19	925.00	T19	1,900.00		
		E20	70.00	B99	*	T99	*		
		E99	*						

*Contact NTIS for price quote.

PRICES EFFECTIVE JANUARY 1, 1987

Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

10 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSSION NUMBER INDEX